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The Variable Tour Experiment in the Army Reserve Components

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PREFACE

This report was prepared as part of Rand's DoD Training and Manpower Management Program, sponsored by the Human Resources Research Office of the Defense Advanced Research Projects Agency (ARPA). With manpower issues assuming an ever greater importance in defense planning and budgeting, the purpose of this research program is to develop broad strategies and specific solutions for dealing with present and future military manpower problems. This includes the development of new research methodologies for examining broad classes of manpower problems, as well as specific problem-oriented research. In addition to providing analysis of current and future manpower issues, it is hoped that this research program will contribute to a better general understanding of the manpower problems confronting the Department of Defense.

The report contains an analysis of an experiment in the Army Reserve Components, begun on July 1, 1973, to test whether reducing the term of enlistment for nonprior servicemen would have a substantial effect upon recruiting. In the experiment, Guard and Reserve units in certain states were permitted to offer potential recruits the option of enlisting in a reserve unit for only three or four years instead of the usual six-year term. The effectiveness of these options in attracting new recruits is evaluated using a cross-sectional analysis of recruiting performance across states, allowing for differences among the states in demographic factors, strength characteristics of the reserve components, and amounts of recruiting activity. The policy implications of the experiment are then considered by weighing the estimated increases in enlistments that are attributable to the options against some of the negative aspects of a shorter enlistment tour in the reserves.

This experiment may be used as a prototype for other experiments in the future to test the effectiveness of recruiting incentives or various types of recruiting efforts. Therefore, a section of the report is devoted to a critique of the experiment, and the methodology for analyzing the data is spelled out in detail.

SUMMARY

Before the variable tour experiment began on July 1, 1973, nonprior servicemen had to enlist in the Army Reserve Components for a period of six years. Although the reserves had little difficulty meeting their manning requirements before the draft ended in December of 1972, enlistments declined sharply in the first quarter of 1973, and Army officials contended that the six-year term was the major impediment to recruiting in a zero-draft situation.

To test their contention, the variable tour experiment was conducted to determine whether shortening the term of enlistment would stimulate recruiting significantly. During the last six months of 1973, certain states were permitted to offer potential recruits either a "3x3" or a "4x2" option. Under the 3x3 option, the recruit effectively cut his commitment to active reserve participation from six to three years, with the remaining three years to be served in the Individual Ready Reserve. The 4x2 scheme meant four years of ordinary reserve duty followed by two years in the IRR.

Although the experiment had a number of flaws (see Section VI), it yielded rough estimates of the effectiveness of the options, as well as a substantial amount of information about the recruiting process in the Army Reserve Components. The main findings are as follows:

1. On average the states that offered the shortened enlistment options outperformed the others by a wide margin during the experimental period, but the experimental states benefited from much more recruiting activity.

2. After allowances are made for differences in recruiting activity and other factors that tended to confound the experimental results, it appears that the 3x3 option resulted in a 20-40 percent increase in nonprior service enlistments during the experimental period, and the 4x2 option yielded a 10-30 percent increase. Since there was such a large amount of unexplained variability in the enlistment rates across states and between time periods within states, the long-term effects of the options cannot be estimated accurately.

3. The experimental results, in conjunction with a study of the effects upon the reserves of shortening the enlistment term indicate that adopting the 3x3 scheme across the board in the Army Reserve Components would probably not attract enough recruits to offset future man-year losses. Moreover, if the 3x3 scheme were adopted, both the experience level and the average length of service of reservists would dip sharply.

4. The estimated response to the 4x2 option during the experiment was close to that required to offset the resulting man-year losses under current reenlistment rates. Although the 4x2 scheme seems preferable to the 3x3 scheme in other respects, personnel costs would rise under both schemes, and other factors should be considered before implementing either scheme.

5. Shortening the term of enlistment, by itself, would contribute little toward solving the "reserve problem." The small increase in non-prior service enlistments now would only contribute to difficulties later on. Also, the options appeared to be less effective in the states that had relatively large deficits in enlisted strength.

6. Certain states conducted highly productive recruiting campaigns during the experimental period, indicating that efforts of this type can yield large numbers of enlistees, with or without shorter tour lengths.

7. Many states performed below par in recruiting during the course of the experiment. The recruiting performances of the states that did not have the options to offer may have been adversely affected by offering the options in the other states.

8. Certain states seem capable of manning larger Army reserve units than they now have. Seven states and Puerto Rico were overstrength at the start of the experiment, and the evidence is clear that their recruiting performances were below what they could have been if they had been able to recruit more freely.

9. The experiment had many shortcomings, both in design and in execution, that may have prejudiced the findings. The lessons learned from this experiment should be considered carefully in setting guidelines for future experimentation of a similar nature.

ACKNOWLEDGMENTS

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CONTENTS

I. INTRODUCTION

With the elimination of the draft in December of 1972, the number of nonprior service (NPS) enlistments into the Army Reserve Components dropped off sharply. Whereas the Reserve Components had averaged about 4000 NPS enlistments per month in 1972, there were fewer than 2000 per month during the first five months of 1973. (See Table 1.) At the same time, large numbers of reservists who had enlisted during the early stages of the Vietnam War were leaving the reserves as their terms of enlistment ended. Requirements for new recruits were rising while enlistments were falling. In March 1973, the Army National Guard (ARNG) enlisted 1519 NPS recruits, just 23 percent of its programmed requirement of 6500 for that month. The situation appeared even more desperate in the United States Army Reserve (USAR), which had only 423 enlistments in March--14 percent of its programmed requirement of 3000 men.

Many military officials felt that the six-year term of enlistment in the Reserve Components was a major obstacle to recruiting once the draft had been eliminated.[1] Although the ARNG and USAR had little trouble meeting their recruiting requirements earlier with a six-year term, most reservists who enlisted between 1956 and 1972 joined to avoid being drafted into the Army or to serve at a time of their own choosing. Apparently the six-year term of enlistment in the reserves was an acceptable alternative to serving two years in the Army as a draftee. With the elimination of the draft, it was thought that few 18-year-olds would commit themselves to a six-year term. Faced with sizable recruiting shortfalls month after month in early 1973, the Army Reserve Components appealed to DoD to shorten the enlistment term to three years as soon as possible.

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[1]Central All-volunteer Force Task Force, Reserve Component Recruiting, Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs), November 1972.

Table 1

NONPRIOR SERVICE ENLISTMENTS,
ARMY RESERVE COMPONENTS,
JANUARY 1972 - MARCH 1974

Month	Nonprior Service Enlistments		
	ARNG	USAR	Total
January 1972	3927	1434	5361
February	3219	582	3801
March	3088	536	3624
April	2111	555	2666
May	2181	408	2589
June	2230	762	2992
July	3422	1161	4583
August	3411	1643	5054
September	3527	1055	4582
October	3316	1585	4901
November	2492	1224	3716
December	1601	785	2386
Total 1972	34525	11730	46255
January 1973	1609	379	1988
February	1329	349	1678
March	1519	423	1942
April	1295	306	1601
May	1366	300	1666
June	2413	193	2606
July	2126	184	2310
August	1693	390	2083
September	1504	439	1943
October	1706	495	2201
November	2112	273	2385
December	2418	260	2678
Total 1973	21090	3991	25081
January 1974	3413	279	3692
February	3860	404	4264
March	2600	421	3021

SOURCE: Major George Weir, Programs and Requirements Team, Reserve Components Office, Office of Deputy Chief of Staff for Personnel, U.S. Army.

Meanwhile the Air Force requested authorization to conduct a controlled experiment in the Air Reserve Forces to determine whether shortening the enlistment tour from six years to either three or four years would stimulate recruiting enough to offset some of the negative features of a shorter tour length. That experiment, which was designed and monitored by The Rand Corporation, began on June 1, 1973, and lasted seven months. It was conducted by offering the shorter enlistment options at a small number of carefully selected reserve units across the nation. The results are summarized in the next section.

Undoubtedly the Air Force test was an important consideration behind the DoD decision to require the Army Reserve Components to conduct a similar experiment in lieu of implementing a three-year enlistment across the board. Although NPS recruiting was running far below programmed levels, the Army Reserve Components were still only about 6.5 percent below desired mobilization levels at that time, and the shortfall was not expected to rise precipitously during the next several months. Apparently DoD officials felt that a short-range experiment was warranted to determine whether the response to the shorter enlistment options would be sufficient to outweigh the increased personnel costs and other negative features associated with a shorter enlistment term.

The variable tour experiment in the Army Reserve Components commenced on July 1, 1973--a month after the Air Force test had begun. The experiment was similar in nature to the Air Force test, except that the shorter enlistment options were offered on a much wider scale. Whereas only a few reserve units in the Air Reserve Forces had been selected to offer shorter enlistment terms on an experimental basis, all Army reserve units in 28 states and the District of Columbia offered a shorter enlistment option during the Army test.

In offering the shorter enlistment options on such a wide scale, the Army Reserve Components were running the risk that the options would not stimulate recruiting appreciably, in which case the net effect of offering the options would be to saddle the reserves with a large group of short-term enlistees, many of whom might have enlisted anyway. The possibility that a shorter enlistment term might be detrimental to the reserves in other ways is indicated by the following considerations:

1. It is estimated in Section IV that, under current retention rates in the Army National Guard, enlistees with a three-year initial commitment would average only 4.6 years of service as compared with 6.7 years of service for the six-year enlistees. Since the six-year enlistees serve approximately 45 percent longer on average than the three-year enlistees, approximately 45 percent more three-year enlistees would be needed to maintain the same size steady-state force. Hence training costs, which are roughly proportional to the number of enlistments, would run about 45 percent higher under a three-year enlistment.

2. Since three-year enlistees would have a shorter average tour length, a smaller proportion of them would reach the higher pay grades. Nevertheless, pay and allowances per reserve man-year would run 10 percent higher for the three-year enlistees than for the six-year group. The reason for this apparent paradox is that personnel costs for reservists are disproportionately high during the initial period of active duty for training.

3. The experience level of the reserve forces would fall. In a steady-state force maintained entirely by NPS enlistments, approximately 60 percent of the men would have less than three years of service, and 21 percent would have less than one year. The corresponding percentages for the six-year group are 42 and 15.

The primary objective of the variable tour experiment was to estimate the responses to the shorter enlistment options. Clearly, there would have to be a substantial increase in NPS enlistments to justify implementing a three-year enlistment for all recruits. Moreover, if the four-year option proved almost as attractive as the three-year option, the four-year scheme would be preferable because its negative features are less pronounced. Whereas the three-year option had to yield a 45 percent increase in NPS enlistments just to offset the man-year losses, the corresponding figure for the four-year option was only 25 percent. Also, training costs and expenditures for pay and allowances would rise only about half as much per reserve man-year under a four-year commitment. Hence there was considerable interest in seeing how much difference the extra year's commitment would make in attracting new recruits.

II. THE EXPERIMENT

The experiment was conducted by permitting reserve units in certain states to offer potential enlistees either a "3x3" or a "4x2" enlistment option. Under the 3x3 option the recruit enlists for three years of unit participation followed by three years in the Individual Ready Reserve (IRR). Under the 4x2 scheme, he commits himself to four years of unit participation followed by two years in the IRR. Under either scheme, as in the usual six-year enlistment, the recruit first undergoes active duty for training that usually lasts four to six months, after which time he returns home to serve in his local reserve unit. His unit participation consists of four 4-hour meetings per month (usually held on the same weekend) and two weeks of training at summer camp. Since participation in the IRR does not entail unit participation, the 3x3 and 4x2 options effectively reduce the enlistment period to three and four years, but individuals in the IRR are subject to being called into active service in the event of war or national emergency.

The states that were permitted to offer the shortened enlistment options were as follows:

3x3	4x2
Connecticut	Arizona
Florida	California
Hawaii	Delaware
Louisiana	District of Columbia
Massachusetts	Kansas
Mississippi	Maryland
New Jersey	Missouri
New Mexico	Nebraska
Ohio	Nevada
Oregon	North Carolina
Pennsylvania	North Dakota
Rhode Island	South Carolina
Texas	Virginia
Washington	
West Virginia	
Wisconsin	

The states not listed above and Puerto Rico served as a control group for the experiment by enlisting male recruits under the usual six-year commitment; this group will be called the "6x0" group below. Female enlistees were not directly affected by the experiment since the usual term of enlistment for women is only three years.

The states that were permitted to offer the 3x3 and 4x2 options were selected by Army officials subject to certain guidelines imposed by DoD.[1] Figure 1 shows that each of the experimental groups was broadly representative in terms of geographic dispersion. However, as will be seen later, there were marked imbalances among the three groups in demographic and strength characteristics. These imbalances were not accidental. The officials who designed the experiment tried to assign the experimental options to those states that were having the most trouble meeting their recruiting requirements. Thus the states in the 3x3 group tended to have greater deficits in strength than those in the other groups, and some of them benefited from intensive recruiting campaigns. Allowances for these factors will be made below in analyzing the effects of the options.

The experiment was originally scheduled to last 90 days. It was later extended by the Assistant Secretary of Defense for Manpower and Reserve Affairs to December 31, providing six months' experience with the enlistment options. Since The Rand Corporation was monitoring the corresponding experiment in the Air Reserve Forces, Rand was asked to monitor the Army test too. To provide timely information on each state's recruiting performance during the experiment, the reserve components in each state submitted "flash reports" on recruiting productivity at the end of each month to the Office of Reserve Components. Data from these reports were forwarded to Rand, where monthly reports on the progress of the experiment were prepared and communicated to Army and DoD officials.

An interesting feature of the experiment was that male recruits in the 3x3 and 4x2 states could enlist for the full six-year term if they wished. To our surprise, a sizable proportion of them chose to do so. The percentages of the men in the experimental states that

[1] These guidelines are listed in Section VI.

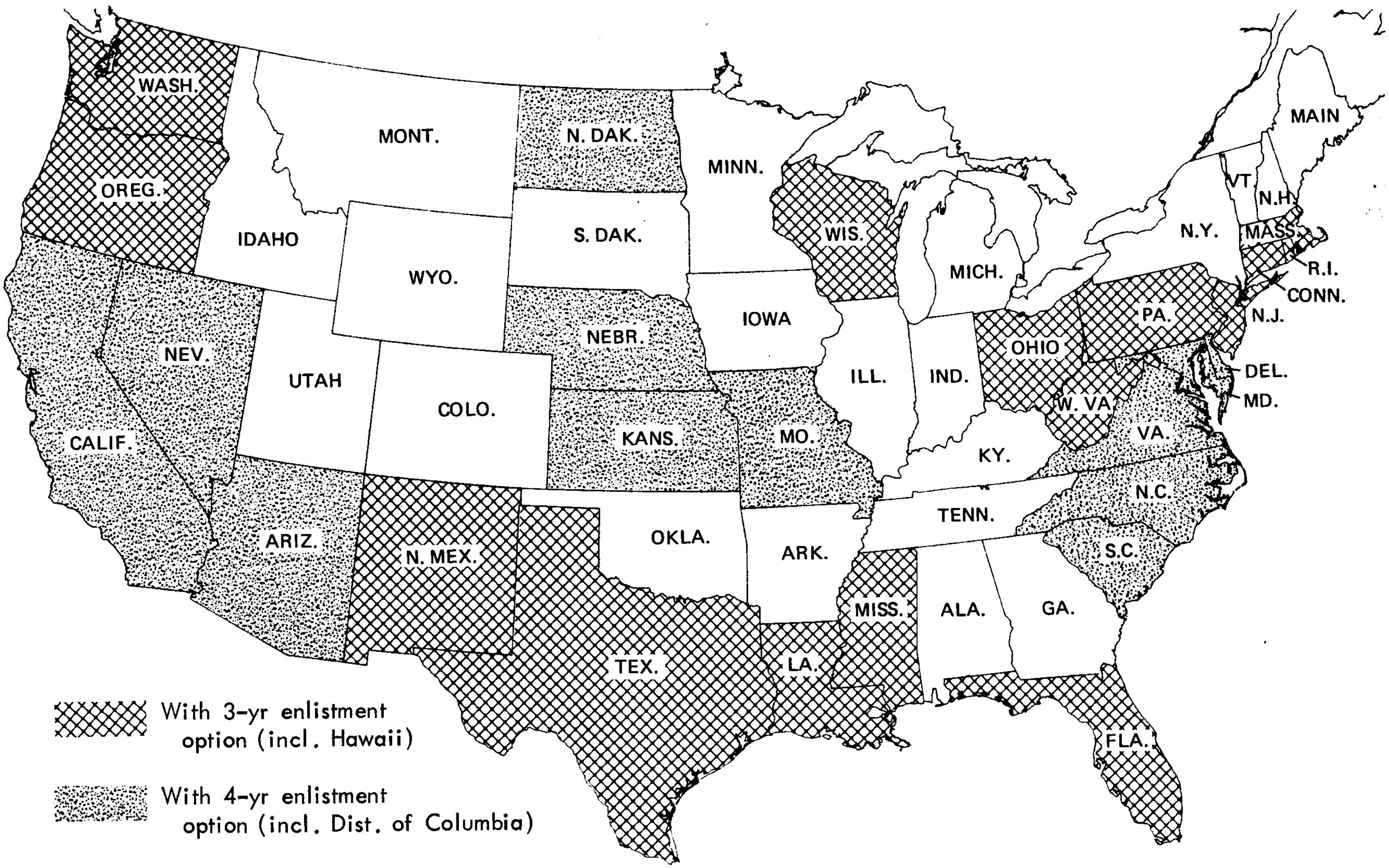

Fig. 1—U.S. Army Reserve variable tour experiment

enlisted for the full six years were as follows:

	July	Aug.	Sept.	Oct.	Nov.	Dec.	July-Dec.
3x3 states							
ARNG	56	38	26	34	34	29	35
USAR	35	32	23	29	41	18	31
Both	51	37	26	33	34	28	34
4x2 states							
ARNG	55	37	41	51	45	37	44
USAR	71	60	58	71	65	74	66
Both	57	41	44	53	46	41	47

Although the proportion of six-year enlistees in the experimental states declined somewhat over the experimental period, the fact that it remained as high as it did remains a puzzle. Some recruiters may have advised recruits not to enlist under the shorter enlistment options to preclude the possibility that the enlistee might be penalized in some way later on, perhaps by losing some or all of the reenlistment bonus that was under consideration by Congress at the time. Other recruiters may not have mentioned the options at all unless the prospective recruit inquired about them.

There is no way of knowing exactly how many of the 3x3 or 4x2 enlistees would have enlisted for the full six-year term if the options had not been available. Therefore, the effectiveness of the options will be analyzed by comparing the overall recruiting performances of the 3x3 and 4x2 states with those in the control group after making adjustments for certain inequities among the groups.

The Air Reserve Forces began their small-scale test of the shortened enlistment options a month earlier than the Army. Unlike the Army test, the Air Force experiment was conducted by offering the 3x3 and 4x2 options at relatively few consolidated base personnel offices (CBPOs). At that time there were 125 CBPOs in the Air Reserve Forces--91 in the Air National Guard and 34 in the Air Force Reserves. To guard against the hazards of offering the enlistment options on a wide scale (see Section VI) and to minimize the negative effects of the shorter enlistment options in the event that they did not prove sufficiently attractive to new recruits, the 3x3 option was offered at only six Guard and five Reserve CBPOs, and the 4x2 option was offered at six Guard and six Reserve CBPOs. The locations of the 23 CBPOs that offered the options are indicated in Figs. 2 and 3. These CBPOs were chosen in such a way that the experimental groups were relatively representative of the entire set of CBPOs in terms of geographical distribution, size and income level of the young male population in the vicinity of the CBPOs, deficits in enlisted strength, and amounts of recruiter activity.

It is doubtful that the Air Force test had a measurable effect upon recruiting in the Army Reserve Components, since the CBPOs that offered the options were widely dispersed and the number of men who enlisted in the experimental CBPOs was fairly small. Altogether only 276 men enlisted in the 3x3 and 4x2 CBPOs over the seven-month period from June 1 to December 31, and 64 percent of these men chose to enlist for a full six-year term instead of enlisting under the option. As these numbers suggest, the shorter enlistment option did not attract many recruits into the Air Reserve Forces. The eleven CBPOs that offered the 3x3 option had an overall enlistment rate for the experimental period of 10.2 male recruits per thousand authorized enlisted strength, which was slightly less than the corresponding rates for both the 4x2 group (10.7) and the control group (10.5). A more detailed analysis, using analysis of covariance to correct for imbalances among the groups on certain demographic and strength characteristics, indicated that the 3x3 and 4x2 groups outperformed the control group by a narrow margin. However, the differences among the groups were not statistically significant, and the estimated responses to the options fell far short of the levels required to offset the man-year losses associated with a shorter initial commitment.

The Marine Corps Reserve also participated in the variable tour experiment during the second half of 1973, offering the 3x3 and 4x2 options in the same states as the Army Reserve Components. Their experience with the options seemed to be similar to that of the Air Force in that there appeared to be no significant differences in recruiting performances among the three groups. However, the experimental results

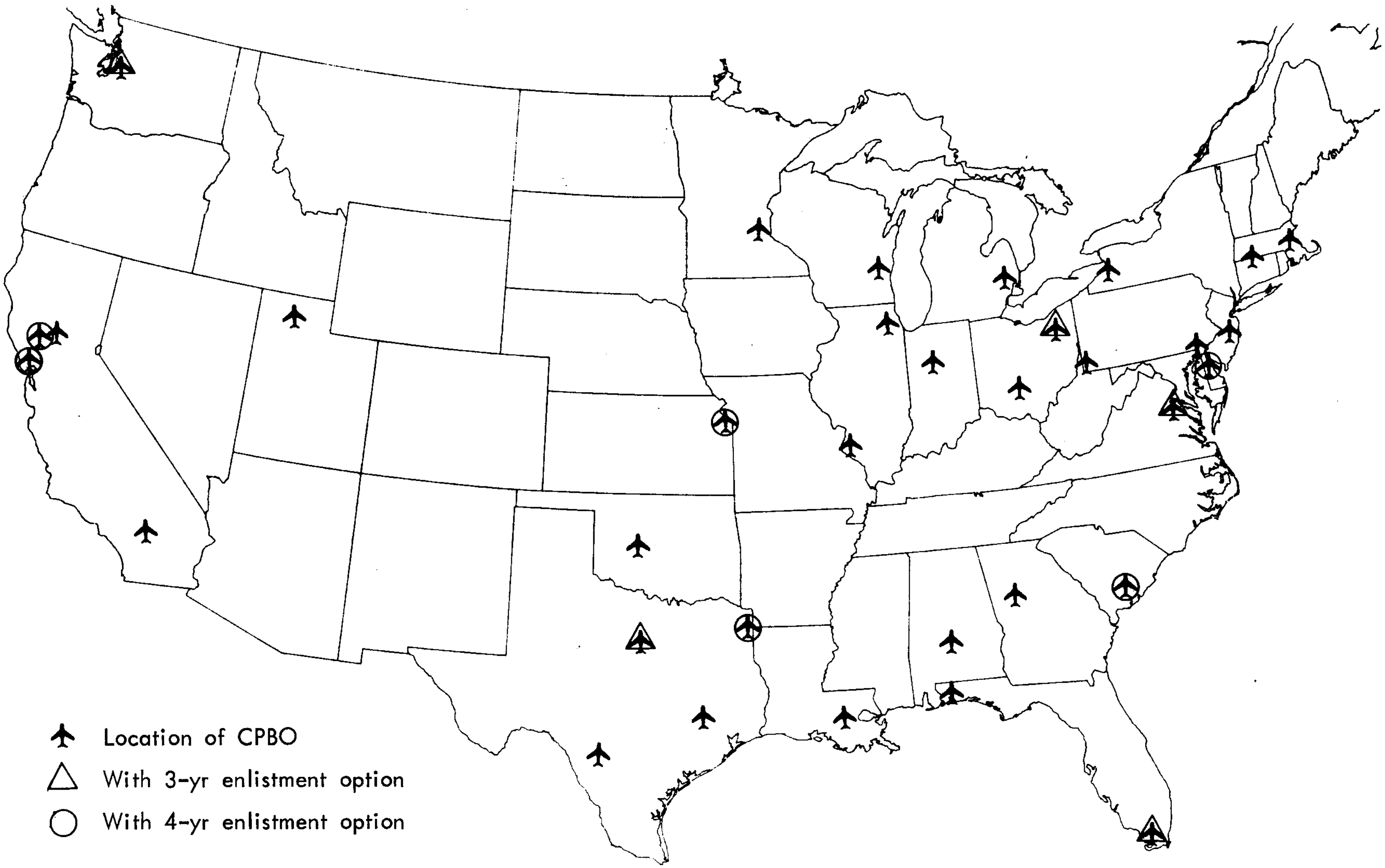

Fig. 2—Air Force Reserve consolidated base personnel offices

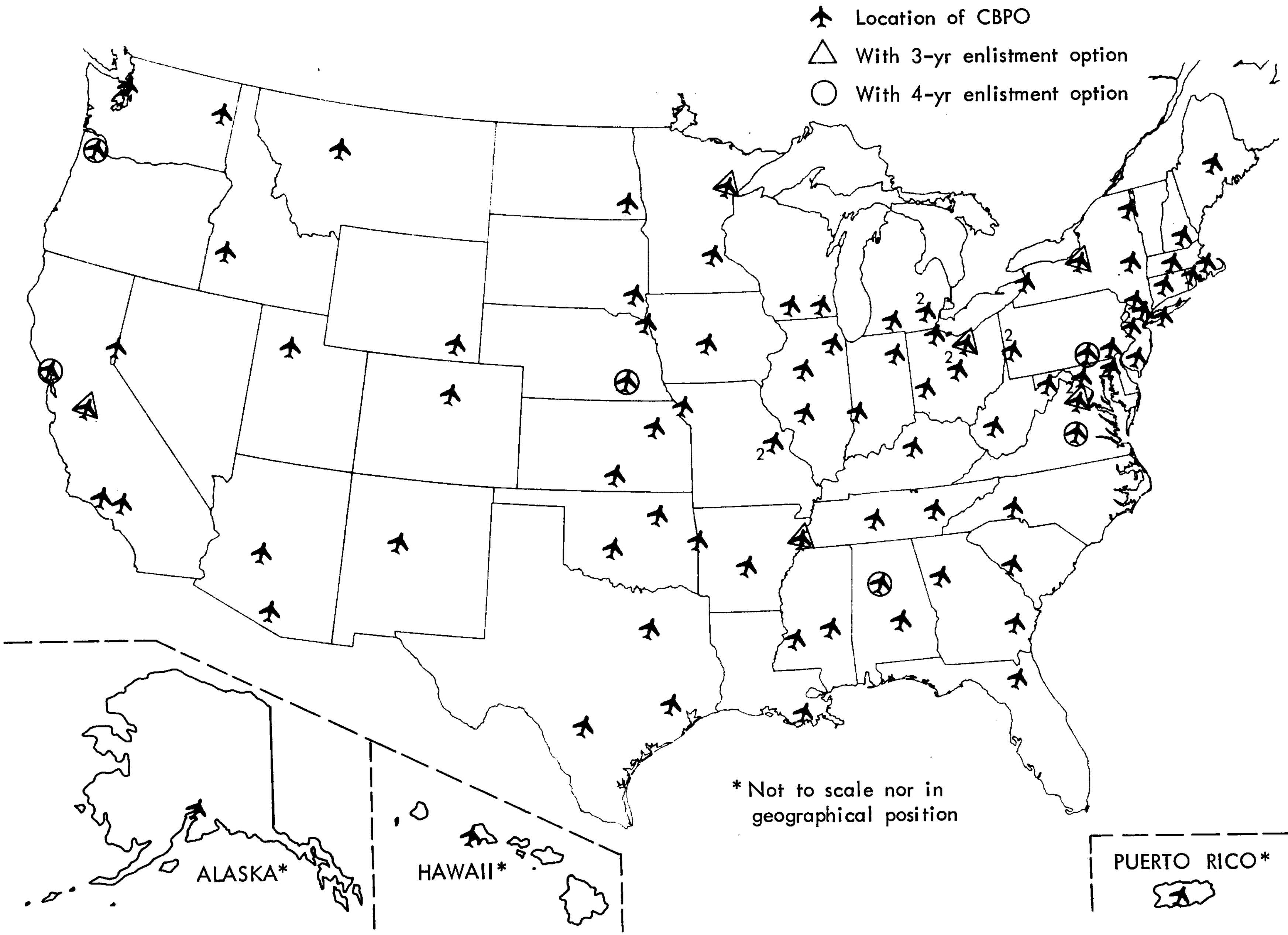

Fig. 3 — Air National Guard consolidated base personnel offices

may have been confounded by the change in the Marine Corps recruiting program during 1973. Since the total number of enlistments into the Marine Corps Reserve during the experimental period was small, the experimental results for the Army Reserve Components were probably not materially affected by the Marine Corps experiment.

III. THE EXPERIMENTAL RESULTS

The complete data set for the variable tour experiment in the Army Reserve Components is given in Appendix A. An examination of the monthly accessions data for the individual states reveals a tremendous amount of variability in recruiting performances both across states and between time periods within states. From Table A.1 we see that Louisiana, a 3x3 state, had 392 ARNG enlistees in a single month during the experiment; sixteen other states had fewer than ten recruits during the same month. Wisconsin, another 3x3 state with a larger population than Louisiana, averaged only nine ARNG enlistees per month during the first five months of the experiment but had 293 accessions in December as a result of an intensive recruiting campaign.

The recruiting performances of the individual states are affected by a number of factors that tend to mask the effects of the shorter enlistment options. Foremost among these are the demand for new recruits, the amount of recruiting effort, the size of the population in the vicinity of the state's reserve units, and the attractiveness of alternative employment and educational opportunities to young people who might consider joining the reserves.

The general approach that will be used in assessing the effectiveness of the options is to compare the overall recruiting performances of the 3x3 and 4x2 states with those in the control group after making allowances for imbalances among the groups on several factors that are related to recruiting performance. But there is no single clear-cut measure of recruiting productivity that can be used in comparing recruiting performances across states or groups of states. And it is not obvious *a priori* how one should adjust the various measures of recruiting productivity that might be used to allow for the imbalances. In part, the imbalances result from the fact that the Army tended to offer the shorter enlistment options in the states that were having the most difficulty meeting their recruiting requirements.

To make matters worse, the ARNG conducted some extremely effective recruiting campaigns in several states during the experiment with the 3x3 states receiving a disproportionate share. Since measures of the amount of recruiting effort that went into the campaigns are not available, special statistical techniques will be required to make allowances for these campaigns in estimating the effects of the enlistment options.

The analysis will proceed by first considering overall measures of recruiting performance for the three groups of states. Then successive refinements to these measures will be made to account for the effects of the recruiting campaigns and other inequities among the groups.

Table 2 presents a comparison of the overall recruiting performances of the three groups of states using various measures of recruiting productivity. In terms of total male enlistments in the Army Reserve Components during the experimental period, the 3x3 states led with 5589, followed by the 6x0 states with 3810 and the 4x2 states with 2959.[1] However, the 4x2 states have a smaller total population to draw from and their total reserve strength is considerably smaller.

To allow for differences in reserve strength in making interstate and intergroup comparisons, the *enlistment rate* for each state (or group of states) was defined to be the number of male NPS accessions per thousand authorized enlisted strength.[2] The combined enlistment rate for both reserve components in the 3x3 states was 25.1, which exceeded the 15.7 rate for the control group by 60 percent. The 4x2 enlistment rate, 23.1, exceeded the control group rate by 47 percent.

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[1]The accessions data used in making the comparisons among the groups in this and the following sections are taken from the monthly "flash reports." The national totals from these reports are not in complete agreement with those reported in Table 1. See Appendix A.

[2]An examination of the ARNG accessions data for the six-month period before the experiment began indicated that the state's authorized reserve strength provided a better predictor of the number of reserve accessions in that state than the size of the college-age male population. Since large segments of the population do not live within commuting distance of a reserve unit, the state's reserve strength may come closer to reflecting the size of the state's manpower pool of potential reservists than the college-age population. Other reasons for adopting this measure will be given below.

Table 2

MEASURES OF RECRUITING PRODUCTIVITY,
ARMY RESERVE COMPONENTS,
JULY 1 - DECEMBER 31, 1973

Experimental Group	Measure of Recruiting Productivity			
	No. of Male NPS Enlistees	Male Enls. per 1000 Auth. Str.	Male Enls. per 100,000 Male Pop., 18-24	Male Enls. as % of Def. in Str.
ARNG				
3x3	4855	35.5	114.8	35.2
4x2	2605	31.3	85.7	32.0
6x0	3304	21.3	73.6	57.6
All groups	10764	28.7	91.5	38.9
USAR				
3x3	734	8.5	17.4	5.6
4x2	354	7.9	11.6	12.6
6x0	506	5.8	11.3	5.7
All groups	1594	7.3	13.6	6.4
ARNG & USAR				
3x3	5589	25.1	132.1	20.7
4x2	2959	23.1	97.4	27.0
6x0	3810	15.7	84.8	26.1
All groups	12358	20.8	105.1	23.5

SOURCE: See Appendix A.

If the three groups had received approximately the same recruiting effort, these percentages would serve as rough estimates of the responses to the 3x3 and 4x2 options. As it is, the percentages surely exaggerate the responses to the enlistment options.

A reasonable alternative to using the enlistment rate as an overall measure of recruiting performance would be to use the size of the relevant male population as a base instead of the total enlisted strength. If the number of male enlistments per 100,000 male population of age 18-24 is used as the performance criterion, then from the entries in Table 2 for both components the 3x3 and 4x2 groups outperformed the control group by 56 and 15 percent. The reason the 4x2 group does not show up as well using this criterion is that California's recruiting performance receives considerably more weight using the male population as a base, since California accounts for 41 percent of the male college-age population in the 4x2 group but only 29 percent of the authorized enlisted strength.

As a rough overall measure of recruiting productivity, the enlistment rate is preferable to this measure based on the size of the college-age male population because: (1) the number of accessions is more closely related to the authorized strength than to the size of the male college-age population (see Section V); (2) large portions of the male population are at a considerable distance from reserve units in sparsely populated states; (3) very large cities tend to yield fewer enlistments per unit of population than smaller cities;[1] (4) the enlistment rate facilitates making interservice comparisons, whereas it is difficult to specify the population within commuting distance of an air base or isolated Marine Corps Reserve unit; (5) the number of recruiters assigned to each state, at least in the ARNG, is approximately proportional to the state's authorized enlisted strength.

As an additional measure of success, Army officials suggested that an index of recruiting performance be used that would be more indicative

[1] Harold E. Klein, "A Study of the Effects of Demographic Characteristics on Armed Services Enlistments," Marcom Incorporated, Kansas City, Kansas, June 1969.

of how well the options were helping to meet the states' manning requirements. This suggestion motivated a comparison of the number of enlistments in each state with the state's deficit in enlisted strength at the beginning of the experiment. As Table 2 shows, male enlistments as a percentage of the deficit in strength were highest for the 4x2 states, followed closely by the 6x0 group. However, the three groups were not comparable in terms of strength deficits at the start of the experiment. The 3x3 group was 12 percent understrength, whereas the 4x2 and 6x0 groups were only 9 and 6 percent understrength. Moreover, the pattern of enlistments both before and during the experiment indicated that the states' recruiting performances were not closely related to their deficits in strength. Some states that were overstrength when the experiment started continued to turn in strong recruiting performances.

None of the measures above takes into account the amount of recruiting effort that went on. Regrettably the costs and man-days expended in recruiting activity within each state are not carefully monitored by the Army, but there is some indication of the amount of recruiting effort that goes on routinely in the Army National Guard. Appendix A lists the number of Guardsmen that were assigned as unit recruiters in each state. These are mostly part-time recruiters who recruit both nonprior and prior servicemen. Each company-level unit employs a minimum of two men, and the length of time an individual works on recruiting depends on the amount of money allocated and the payrate of the recruiter. The counts of recruiters do not include either the recruiting program managers and their assistants at the state headquarters or the Guardsmen located at various installations throughout the United States whose primary function is to recruit prior servicemen as they are separated from active duty.

Appendix A also lists the amounts of money that were allocated by the Guard to each state for direct recruiting obligations during the period July 1 to December 31, 1973. Table 3 compares the three experimental groups on these measures of recruiting activity. In terms of the number of recruiters assigned relative to the sizes of the reserve

Table 3

RECRUITERS AND ALLOCATIONS FOR DIRECT RECRUITING OBLIGATIONS
ARMY NATIONAL GUARD

Experimental Group	Auth. Enl. Strength June 30, 1973	No. of Recruiters		Direct Recruiting Obligations	
		Total	Per 1000 Auth. Str.	Total	Per 1000 Auth. Str.
3x3	136,756	2809	20.5	$2,664,898	$19,487
4x2	83,152	1749	21.0	1,468,589	17,661
6x0	154,829	3311	21.4	2,308,795	14,912
All groups	374,737	7869	21.0	6,442,282	17,191

units, differences among the three groups were slight. However, the 3x3 and 4x2 states received substantially more money per man for recruiting activity during the experimental period. This apparent inequity is understandable since the experimental states had greater strength deficits at the start of the experiment, but it is a factor to be considered in evaluating the enlistment options.

The amounts of recruiter activity indicated in Table 3 do not account for the highly productive recruiting campaigns that were conducted in certain states during the course of the experiment. Many ARNG technicians who were not ordinarily engaged in recruiting activity took time off from their usual duties to work as recruiters during these campaigns. Regrettably, data on the number of man-days involved in the campaigns are not available.

The four most successful campaigns were conducted in Louisiana, Massachusetts, New Jersey, and Wisconsin, all of which were 3x3 states. The monthly accessions data for these states are provided in Table 4. The recruiting performances during the months of the campaigns are marked with asterisks. The effectiveness of the campaigns is clear from the singular increases in NPS enlistments during the months in which the campaigns were conducted.

Of the 2324 male NPS enlistments in these four states during the experimental period, over half (1234) were obtained during the single

Table 4

MALE NONPRIOR SERVICE ENLISTMENTS IN SELECTED STATES,
ARMY NATIONAL GUARD,
July - December 1974

State	Male NPS Enlistments						
	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Louisiana	106	63	67	79	347*	86	748
Massachusetts	24	48	33	263*	80	37	485
New Jersey	65	128	127	338*	68	34	760
Wisconsin	8	11	12	5	9	286*	331

months in which the recruiting campaigns were conducted. Moreover, these four states accounted for almost one-half of the 4855 enlistments in the 3x3 states during the six-month period. Since recruiting campaigns were also conducted in other 3x3 states and since the experimental groups appear to have benefited far more from this activity than the control group, the proportion of recruits who enlisted during these campaigns is not a negligible factor in assessing the enlistment options.

Although one can argue that having the 3x3 options to offer potential recruits contributed greatly to the success of these campaigns, similar campaigns conducted in 6x0 states were also remarkably successful. (See Appendix B.) Moreover, the recruiting campaigns were notably successful in attracting female enlistees into the Guard, although women were not directly affected by the options. Louisiana enlisted 45 women into the ARNG during its recruiting campaign in November, as compared with a total of only 17 during the previous four months. Wisconsin enlisted seven women during its December campaign, after enlisting no women during the previous five months. Thus, the campaigns yielded extraordinary results, with or without the options. Although the recruiting campaigns seemed to be more effective in the 3x3 states than in the others, these very short-term blitzes of recruiting activity provide little information about the long-term effects of the options themselves, except perhaps to indicate that other factors are probably far more important in the recruiting process. In fact, insofar as evaluating the options is concerned, the recruiting campaigns only served to confound the analysis. Fortunately, the campaigns had little carry-over effect into succeeding months, so that individual months of extraordinary recruiting performance could be isolated and taken into account in the analysis.

Various schemes were considered for handling the data to allow for the effects of the recruiting campaigns and to provide a data base that was more representative of the states' recruiting performances under ordinary levels of recruiting effort. In the absence of information on the amount of effort that went into the recruiting campaigns, the author first considered excluding from the analysis those states in which recruiting campaigns were known to have occurred. But Army officials objected to doing this on the grounds that it would eliminate many of the more populous 3x3 states in which the 3x3 option seemed to be working well. Also, it was argued that the states are expected to push their reserve recruiting programs continually, making it impossible to identify all states that have unusual recruiting activity at any point in time.

This led to consideration of using purely statistical procedures for identifying the states that had intensive recruiting campaigns, as evidenced by an unusually large number of recruits during a single month of the experiment. Statistical tests for "outliers" tailored to the type of data available in this experiment were used to confirm that for many states the month-to-month variability in recruiting performances was far greater than one would expect from random fluctuations if recruiting effort were constant over time. The rationale behind these procedures, the results of the tests, and the estimates of the effects of the known recruiting campaigns are given in Appendix B.

Although the methodology permitted subtracting out the estimated effects of the recruiting campaigns from each state's monthly enlistment data, this procedure was not used in evaluating the options. The reason is that, since more 3x3 states than 6x0 states were known to have conducted campaigns, any procedure that modified the data for only those states identified as having extraordinary recruiting activity would surely prejudice the evaluations of the enlistment options. Instead, two standard techniques for estimating mean responses in the presence of possibly spurious observations were applied--trimming and Winsorization.[1] Since there were only six observations for each state (the monthly numbers of male recruits) and the recruiting campaigns seemed to have a marked effect for only a single month, the author chose to trim or Winsorize only the largest and smallest observation for each state. As an illustration of these procedures, Wyoming, a 6x0 state, had 70 male NPS recruits in the ARNG during the experimental period, 47 of whom enlisted during its November recruiting campaign. Wyoming's monthly totals were: 3, 4, 4, 2, 47, 10. Under trimming, the largest and smallest observations, 47 and 2, were excluded, and the average of the others, 5.25, was used to estimate the mean monthly response for the state in the absence of the campaign effect. Multiplying this monthly estimate by six, to get 32, provides an estimate of what Wyoming's recruiting performance would have been over the six-month period in the absence of its recruiting campaign. Under Winsorization, the largest and smallest observations, 47 and 2, are replaced by the next largest and next smallest, 10 and 3, in estimating the mean monthly response. This yielded an estimate of 5.67 per month for a six-month total of 34. Note that the edited totals, 34 and 32, differ little in this case.

Both the trimmed and Winsorized six-month totals for each state are provided in Appendix B. In those states where the largest monthly total is close to the next largest monthly total, the edited six-month totals differ little from the totals for the original data. The editing process makes a substantial difference only for states that had an

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[1]The Winsorization process is named after Charles P. Winsor, who recommended replacing an outlier in a sample by the nearest value of an observation that was not seriously suspect. For discussions on testing for outliers and estimating parameters in the presence of "wild shots," see John W. Tukey, "The Future of Data Analysis," The Annals of Mathematical Statistics, Vol. 33, No. 1, March 1962, pp. 1-67, and Frank E. Grubbs, "Procedures for Detecting Outlying Observations in Samples," Technometrics, Vol. 11, No. 1, February 1969, pp. 1-21.

extraordinarily large number of recruits during a single month relative to the other months. In either case the differences between the two edited totals are small, and the correlation coefficient between the trimmed totals and the Winsorized totals across states is 0.999. Since the two sets are this closely related and the analysis of the effectiveness of the options remains almost exactly the same under the two sets, only the calculations for the Winsorized totals will be reported below.

Since the edited data for ARNG reflect the states' recruiting performances under ordinary levels of effort, they also afford a more precise analysis of the effectiveness of the options in the ARNG. Although a detailed analysis of the enlistment rates to allow for differences in the states' demographic characteristics will be deferred until Section V, the edited data may be used to reconstruct the overall measures of recruiting productivity that were provided in Table 2 for each of the three groups. (See Table 5.) Since the USAR benefited little from the ARNG's recruiting campaigns, the USAR statistics have not been changed from those presented in Table 2.

If the combined enlisted rate (male NPS accessions per thousand authorized strength) is used as the criterion, the 3x3 states still outperformed the 6x0 group by 48 percent; but that figure is considerably less than the 60 percent figure from the unedited data. The 49 percent margin for the 4x2 group over the control group is nearly unchanged from the 47 percent margin computed from the unedited data. This is consistent with the calculations in Appendix B which shows that the 4x2 group did not appear to benefit nearly so much from the recruiting campaigns as the 3x3 group. Note that the sizable difference in the overall enlistment rates between the 3x3 and 4x2 group in Table 2 almost disappeared when the edited data were used, but there are other imbalances among the groups in demographic and strength characteristics to be considered.

The results of a more detailed analysis in Section V indicate that the 3x3 group outperformed the 4x2 group by about 10 percent, but the

Table 5

MEASURES OF RECRUITING PRODUCTIVITY BASED ON THE EDITED DATA
ARMY RESERVE COMPONENTS
JULY 1 - DECEMBER 31, 1973

Experimental Group	Measure of Recruiting Productivity: No. of Male NPS Enlistees	Male Enls. per 1000 Auth. Str.	Male Enls. per 100,000 Male Pop., 18-24	Male Enls. as % of Def. in Str.
ARNG				
3x3	3875	28.3	91.6	28.1
4x2	2312	27.8	76.1	28.4
6x0	2895	18.7	64.5	50.4
All groups	9082	24.2	77.2	32.8
USAR				
3x3	734	8.5	17.4	5.6
4x2	354	7.9	11.6	12.6
6x0	506	5.8	11.3	5.7
All groups	1594	7.3	13.6	6.4
ARNG & USAR				
3x3	4609	20.7	109.0	17.1
4x2	2666	20.8	87.7	24.3
6x0	3401	14.0	75.7	23.3
All groups	10676	18.0	90.8	20.3

SOURCE: See Appendix B for edited data on male NPS enlistments in the ARNG. Other data are from Appendix A.

difference between the groups was not statistically significant.[1] In the ARNG, after allowing for differences among the groups in demographic characteristics, deficits in strength, and preexperimental recruiting performances, it is estimated that the adjusted enlistment rates for the 3x3 and 4x2 groups exceeded the rate for the control group by about 30 and 20 percent, but these estimates should be treated as being rather imprecise. The corresponding analysis for the USAR could not be carried out since certain important variables were missing. However, since the USAR enlisted less than one-sixth as many men as the ARNG during the experimental period and since the overall enlistment rates for the three groups in the USAR were approximately proportional to the corresponding rates in the ARNG, the inclusion of the USAR data in the analysis would not have changed the estimated percentage differences appreciably.

Although the 3x3 and 4x2 groups outperformed the control group by about 30 and 20 percent based on the adjusted enlistment rates, the increases were not necessarily entirely attributable to the appeal of the shortened enlistment options to potential recruits. There are at least two other possibilities. First, one must keep in mind that the men who join the reserves constitute only a tiny proportion of the college-age male population,[2] and it may very well be that to men who would join the reserves under zero-draft conditions the tour length is a matter for discussion and concern but not an impediment to enlisting. However, the recruiters are apparently convinced that the six-year term is a major obstacle to reserve recruiting, and they may have become more aggressive in their recruiting once they had the options to offer. If that were the case, the options should have had only a

[1]Several estimates of the 3x3 and 4x2 effects are provided in Section V, depending on the variables that are used in adjusting for the imbalances among the three groups and the statistical procedure used in making the adjustment. The procedure that seems most appropriate in this case yields estimates of the 3x3 and 4x2 effects that are 30 and 19 percent respectively above the 6x0 enlistment rate.

[2]Altogether, approximately 23,000 men joined the Army Reserve Components as NPS enlistees in 1973, and there were approximately 13 million men in the 18-24 age group. Thus, there were only two enlistments for every thousand men in the college-age group.

transitory effect upon recruiting, with the experimental groups outperforming the control group at first, followed by a narrowing of the margin as the recruiters lost their enthusiasm for the options.[1] Table 6 shows the monthly enlistment rates for both the USAR and ARNG during the experimental period, calculated from both the original and the edited data.[2] The percentages by which the 3x3 enlistment rates exceeded the 6x0 rates, calculated from the edited data, for each of the six months of the experiment are 45, 58, 62, 57, 48, and 26.[3] The first of these percentages resulted from the underreported data for the first month of the experiment; the trend in the other figures suggests that the effect of the 3x3 option was lessening over time. However, the corresponding percentages by which the 4x2 enlistment rates exceeded the 6x0 rates over the six months (73, 42, 33, 38, 56, 44) do not reveal the same pattern, and it is impossible to conclude with any degree of certainty that the enlistment options had a transitory effect over time.

There is a second important consideration in deciding to what extent the estimated percentages (30 and 20) by which the 3x3 and 4x2 groups outperformed the control group were attributable solely to the options. Did the 6x0 states function as a proper control group during the experimental period or was their recruiting performance in fact adversely affected by offering the options in the other states? It was no secret that many Army recruiters and officials wanted to see the experiment confirm their claims that the three-year enlistment tour would increase NPS enlistments substantially, and many of them regarded the experiment as a nuisance to be barely tolerated through its original

[1]This was apparently what happened in the corresponding experiment in the Air Reserve Forces.

[2]The edited data compensate for the recruiting campaigns conducted during the last three months of the experiment, but they only partly compensate for the underreporting of the numbers of enlistees on the "flash reports" during the first month of the experiment. See Appendix B.

[3]The corresponding percentages calculated from the original data were 55, 58, 36, 160, 75, 21.

Table 6

MONTHLY ENLISTMENT RATES, ARMY RESERVE COMPONENTS, JULY-DECEMBER 1975

Experimental Group	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Male NPS Enlistments per 1000 Authorized Strength							
3x3	3.1	4.1	3.4	5.2	4.9	4.6	25.1
4x2	3.9	3.3	2.7	3.0	5.3	4.8	23.1
6x0	2.0	2.6	2.5	2.0	2.8	3.8	15.7
All groups	2.8	3.3	2.9	3.4	4.1	4.3	20.8
Monthly Enlistment Rates Calculated from Edited Data							
3x3	3.2	3.8	3.4	3.3	3.7	3.4	20.7
4x2	3.8	3.4	2.8	2.9	3.9	3.9	20.8
6x0	2.2	2.4	2.1	2.1	2.5	2.7	14.0
All groups	2.9	3.1	2.8	2.7	3.2	3.2	18.0

90-day trial period. It is not inconceivable, given the wide-scale nature of the test and the publicity at the start, that certain unit commanders in 6x0 states might have postponed some of their recruiting activities for a month or two until the 3x3 scheme became available in all states. Nor is it inconceivable that certain recruiters in 6x0 states may have recommended to potential recruits that they wait a couple of months and get a shorter period of enlistment.

To determine whether the 6x0 states were performing up to par during the experimental period, one can compare the monthly recruiting performances of the 6x0 states both with their own performances before and after the experiment and with the recruiting performances of the reserve components in the other services. Table 7, which gives the monthly numbers of NPS enlistments in the ARNG by experimental group before, during, and after the experiment,[1] indicates that the 6x0 states

[1] The corresponding data for USAR are not available on a state-by-state basis.

Table 7

NONPRIOR SERVICE ENLISTMENTS BY MONTH AND EXPERIMENTAL GROUP, ARMY NATIONAL GUARD, JANUARY 1973 - MARCH 1974

Month	Nonprior Service Enlistments			
	3x3 States	4x2 States	6x0 States	Total
1973				
January	631	545	644	1820
February	496	308	504	1308
March	513	442	609	1564
April	459	385	650	1494
May	534	530	631	1695
June	999	574	965	2538
January-June	3632	2784	4003	10419
July	845	679	602	2126
August	758	375	567	1700
September	653	314	552	1519
October	1072	358	448	1878
November	1049	672	646	2367
December	992	596	900	2488
July-December	5369	2994	3715	12078
1974				
January	1320	538	1551	3409
February	1995	967	897	3859
March	801	504	897	2202
January-March	4116	2009	3345	9470

SOURCE: Data for the first half of 1973 and the first part of 1974 were supplied by members of the Enlistment Management Team, Office of Reserve Components, U.S. Army. The monthly totals for the second half of 1973 are taken from the flash report data (see Appendix A) except for July, the first month of the experiment, when the flash reports were known to have underreported the number of enlistments in many states. The July figures in the table result from disaggregating the monthly total of ARNG in Table 1 using the monthly proportions of enlistments in each of the three groups calculated from the flash reports. The other monthly totals do not agree with the official figures in Table 1, because certain states' recruiting performances were not yet available at the time that the official figures were compiled.

had 4003 NPS enlistees during the first half of 1973, but only 3715 during the second half. Thus, even though some of the 6x0 states benefited from extremely productive campaigns, recruiting was down by 7 percent in the second half of 1973.[1]

How does this compare with other reserve components? Although both the Naval Reserve and the Marine Corps Reserve underwent changes during 1973 that make comparisons difficult,[2] the performance of the Air Reserve Forces can be used as a standard in assessing the performance of the ARNG 6x0 group. In the Air National Guard (ANG), NPS recruiting was up by 23 percent during the second half of 1973, and the Air Force Reserve (AFRES) showed an increase of 16 percent. A few units in the Air Reserve Forces offered shortened enlistment options beginning in July of 1973, but even if one excludes <u>all</u> the men who enlisted under the 3x3 or 4x2 schemes (some of whom would have enlisted anyway under a 6x0 scheme), recruiting was still up by 18 percent in the ANG and by 6 percent in AFRES.[3]

Other evidence to indicate that the 6x0 states performed below par during the experimental period is the extent to which recruiting picked up in January of 1974. There were 1551 enlistments in the 6x0 states in January, as compared with 897 in December and an average of less than 600 during the previous five months. Undoubtedly part of this surge was attributable to special recruiting campaigns in January (Tennessee had

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[1]It may be argued that recruiting is usually down in the second half of the year because of seasonal factors, but this assertion is suspect since the data for previous years were confounded by the draft. Table 1 indicates there were more enlistments in the Army Reserve Components in the second half of 1972 than in the first half. However, there were more inductions into the Army during the second half of 1972 than there were in the first half, which suggests that there was more draft pressure during the latter half of 1972.

[2]The Naval Reserve counts of NPS accessions in the first half of 1973 included large numbers of men who entered the reserves after completing two years of active service to be followed by six years of reserve duty. The Marine Corps Reserve instituted "one-stop" recruiting in the middle of 1973--i.e., the responsibility of reserve recruiting was turned over to the active duty recruiters.

[3]The ANG and AFRES had 945 and 527 NPS enlistments during the first half of 1973, as compared with 1160 and 613 during the second half. (Source: Colonel E. C. Stewart, OASD (M&RA).) Only 47 men in the ANG and 52 in the AFRES enlisted under either the 3x3 or 4x2 option.

280 enlistments, New York 258) and there was a jump in unemployment rates across the United States in January that may have stimulated enlistments. But one cannot help wondering if the sudden success of so many 6x0 states in January was somehow related to the ending of the experiment in December, especially since the number of recruits dropped back to the December level again in February and March. Did the January recruits suddenly stop waiting for the shortened enlistment tours? Did the recruiters and unit commanders undertake some activities that had been put off earlier? Were some of the December enlistees not counted until January? Whatever the reason, the evidence seems to support the contention that the 6x0 states were not performing up to par during the experiment.

It is impossible to determine the extent to which the estimates of the effects of the options should be deflated to account for the subpar performances of the 6x0 states. In the author's opinion, the correction needed may be quite small. The reason is that, although the detailed analysis in Section V cannot account directly for possible subpar performances on the part of certain 6x0 states, it does so indirectly in that the analysis of the options makes allowances for differences among the states in strength deficits, and most of the drop in the recruiting performance of the 6x0 group occurred in states that were either overstrength or close to it. Since the 6x0 states with large deficits in strength seemed to perform quite well during the experimental period, and since most of the states that were close to being up to strength were in the 6x0 group, making allowances for differences in strength deficits in comparing the enlistment rates tends to make allowances for subpar performances on the part of the 6x0 states.

It would be convenient to adopt the position that the drop-off in enlistment rates in the 6x0 states during the second half of 1973 was entirely attributable to their strength postures. However, this would ignore the surge of enlistments in the 6x0 states in January. Also, it ignores Louisiana's outstanding recruiting performance during the experimental period. Louisiana, a 3x3 state, whose ARNG units were overstrength at the start of the experiment, had the highest enlistment rate among all states during the experimental period, and it conducted the most productive recruiting campaign, netting 347 men and 45 women during a single month. Louisiana's performance shows that being overstrength may not have been as much of a handicap as the performances of certain 6x0 states would indicate.

In summary, the 6x0 group seems not to have been recruiting up to par during the experimental period, but it is difficult to estimate the extent to which they were underperforming. Since the option effects are estimated by comparing the recruiting performances of the experimental states with those in the control group, it may be the case that the estimates of the effects, which credit the 3x3 and 4x2 options with increasing nonprior service enlistments by 20-40 and 10-30 percent, should be deflated somewhat. For purposes of illustration in the next section, the increases in enlistments attributable to the 3x3 and 4x2 options will be estimated as 30 and 20 percent, but needless to say the responses to the shorter enlistment terms cannot be estimated with precision.

IV. THE POLICY IMPLICATIONS

Suppose that implementing the 3x3 enlistment option across the board would result in a 30 percent increase in male NPS enlistments. Would it be beneficial in the long run for the reserves to offer this option to all potential recruits?

To see how shortening the tour length would affect the enlisted force structure in the reserves, consider two cohorts of NPS recruits, one consisting of 1000 6x0 enlistees and a second of 1300 3x3 enlistees. Each group would have a certain amount of attrition each year due to death, disability, transfers out of the reserve, and other factors. Let us assume that the losses due to attrition amount to approximately 5 percent of the force each year until the initial commitment is served and 10 percent per year thereafter. These rates of attrition are close to the current actual figures in the Army Reserve Components. Let us also assume for purposes of illustration that 25 percent of the men in each group reenlist at the end of their initial tours.[1] This is close to the current first-term reenlistment rate in the ARNG and about double the current rate in the USAR.

Figure 4 shows how the sizes of the two groups compare over time under these assumptions. Although the 3x3 group remains 30 percent larger than the 6x0 group during the first three years, it becomes less than one-third as large during the next three years. Beginning with the sixth year the 3x3 group remains approximately 10 percent larger than the 6x0 group.

If a 25 year retirement horizon is assumed for both groups, then the total number of man-years served by the 1000 six-year enlistees is 6670, whereas the 1300 three-year enlistees serve a total of only 6000 man-years. (See Appendix D.) Even though the three-year group contains 30 percent more men initially, the loss in man-years between the third and sixth year for the three-year group is so large that the smaller six-year group actually serves 11 percent more reserve time.

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[1] Other things equal, we would expect the 6x0 cohort to have a higher reenlistment rate than the 3x3 cohort, because the additional men recruited under the 3x3 plan would probably be less favorably disposed toward military service. Thus, assuming the same first-term reenlistment rates for both groups may bias our results in favor of the 3x3 option.

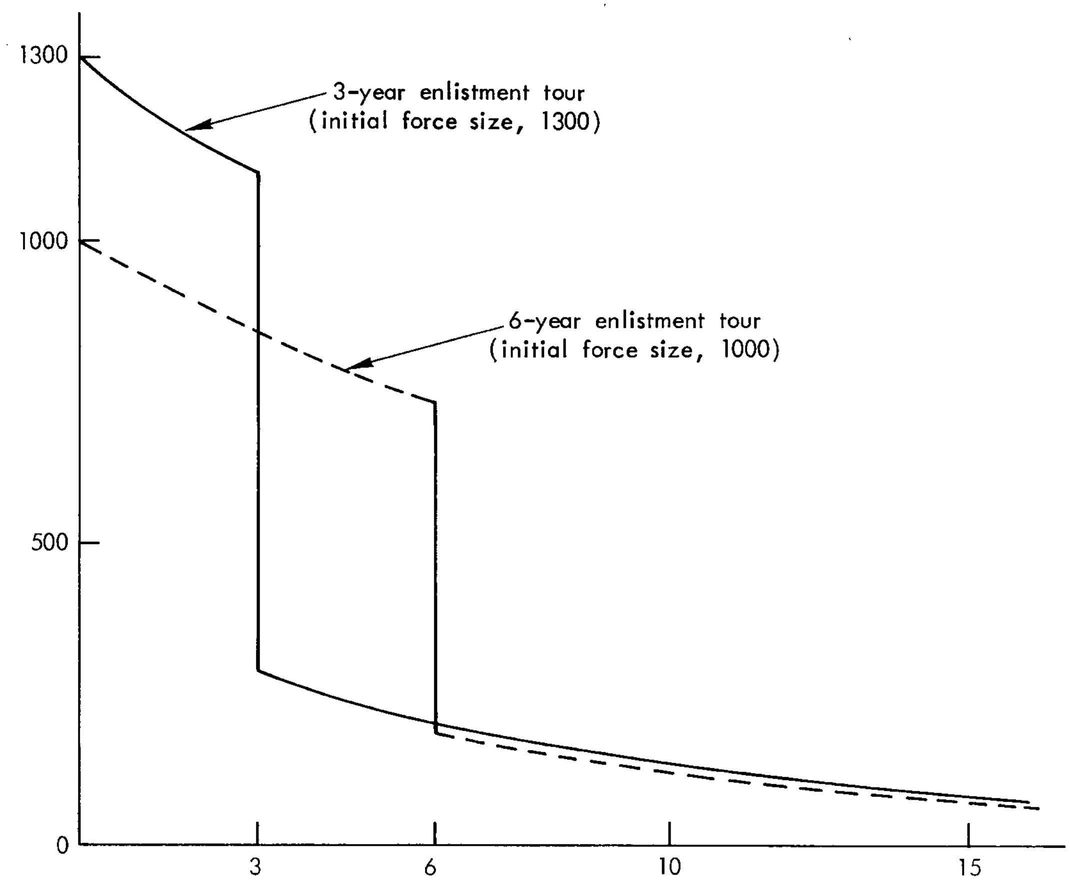

Fig. 4—Comparison of force sizes over time under 3-year and 6-year initial enlistment tours

These calculations ignore the fact that the recruits usually spend from four to six months (and sometimes much longer) on active duty for training before they begin their unit participation. In terms of unit participation time, the six-year enlistees serve 15 percent more man-years than the three-year group.

The assumptions above have not included further drops in the force sizes to account for later reenlistment points, but as Fig. 4 indicates and calculations in Appendix D confirm, both force sizes are considerably reduced after six years, and minor deviations from the assumptions, except for the first-term reenlistment rate (see below), have hardly any effect on the comparisons. The basic difference between the two groups is that, under a 25 percent reenlistment rate, the expected length of service for a reservist under the three-year commitment is only 4.61 years, which is about two-thirds that for a six-year enlistee--namely, 6.67 years.

As Fig. 4 suggests, the comparisons between the two groups are sensitive to the assumption that the first-term reenlistment rate would be 25 percent for both groups. Table 8 contains the expected lengths of service for other reenlistment rates, as well as those for an initial tour length of four years.

Table 8

EXPECTED LENGTH OF SERVICE FOR RESERVISTS UNDER 3, 4, AND 6 YEAR INITIAL TOUR LENGTHS AND VARIOUS REENLISTMENT RATES

First Term Reenlistment Rate	Expected Length of Service if the Initial Tour Length is		
	3 Years	4 Years	6 Years
0.10	3.51	4.30	5.77
0.15	3.88	4.65	6.07
0.20	4.25	4.99	6.37
0.25	4.61	5.34	6.67
0.30	4.98	5.68	6.98

SOURCE: See Appendix D.

A 30 percent response in NPS enlistments to the three-year enlistment term would not be sufficient to offset the resultant man-year losses under current reenlistment rates. What response to the three- of four-year terms is needed to offset the man-year losses?

Table 8 indicates that, under a 25 percent reenlistment rate, the six-year enlistees average 6.67 years of service, which exceeds the 4.61 average for three-year enlistees by 45 percent. It follows that one needs 45 percent more three-year enlistees to man the same size steady state force, and the estimated response to the 3x3 option during the experiment was considerably less than 45 percent.

Table 9 gives the corresponding responses needed to offset the man-year losses under both the three- and four-year terms and for other reenlistment rates. Note that, under a 25 percent reenlistment rate, the response to the four-year term needed to offset the man-year losses is 25 percent. Although the estimated response to the 4x2 option in the Army Reserve Components may have been close to 25 percent, the USAR currently has a first-term reenlistment rate of about 10 to 15 percent, so that unless the USAR can increase its reenlistment rate considerably the response to the four-year term would not be sufficient to offset the man-year losses in a steady state situation.

Table 9

ENLISTMENT RESPONSE RATES REQUIRED TO MAINTAIN FIXED SIZE STEADY STATE FORCE UNDER VARIOUS REENLISTMENT RATES

First-term Reenlistment Rate	Percentage Increase in Enlistments Required if Initial Term of Enlistment is	
	3 Years	4 Years
0.10	64%	34%
0.15	56	31
0.20	50	28
0.25	45	25
0.30	40	23

SOURCE: See Appendix D.

Table 10 provides another perspective on the effects of shortening the enlistment tour. Consider that segment of the reserves made up of those men who enlisted in the reserves as NPS enlistees (excluding those men who entered the reserves after serving on active duty). Under current attrition rates and a first-term reenlistment rate of 25 percent, one needs 15,000 NPS six-year enlistments per year to maintain a steady-state force of 100,000 men. The corresponding figures under three-year or four-year initial tours are 21,700 and 18,700. Expenditures for training, recruiting, uniforms, travel, pay and allowances during active duty for training, and other personnel costs would rise proportionately.

Table 10

NUMBER OF NONPRIOR SERVICE ENLISTEES REQUIRED PER YEAR TO MAINTAIN A STEADY STATE FORCE OF 100,000

First-term Reenlistment Rate	Number of NPS Enlistees Required if Initial Term of Enlistment is: 3 Years	4 Years	6 Years
0.10	28,500	23,300	17,300
0.15	25,800	21,500	16,500
0.20	23,500	20,000	15,700
0.25	21,700	18,700	15,000
0.30	20,100	17,600	14,300

Another factor implicit in shortening the initial enlistment tour is that the experience level of the force would decline. To see this, consider two steady-state forces, one maintained by 1000 NPS enlistees per month under a six-year tour and a second by 1300 three-year enlistees. Then the "force profiles" of the two forces would have the same shapes as the plots in Fig. 1. Changing from a six-year term to a three-year term would mean that a larger proportion of the men in the force would have less than three years of service. Using the same yearly attrition rates and first-term reenlistment rates as before, one can show that in a steady-state force maintained by a three-year enlistment 60 percent of the men would have less than three years of service and 21 percent would have less than a year. Under the six-year scheme, 42 percent would have less than three years of service and 15 percent would have less than a year.[1]

The complications involved in attempting to compare personnel costs per enlistee or per man-year in the reserves under the three initial tour lengths were beyond the scope of this study. Only the costs for pay and allowances will be considered here. Although this oversimplification misrepresents the true personnel costs associated with manning the reserves, the resulting comparisons nevertheless shed some light on how shortening the initial tour length affects an important component of personnel costs. Also, other costs, such as expenditures for training, recruiting, and personnel administration are roughly proportional to the number of enlistments and can be estimated using Table 10.

Since three-year enlistees would have a shorter average tour length, pay and allowances per enlistee would decline under a three-year initial tour length. Also a smaller proportion of them would reach the higher pay grades. But pay and allowances per <u>man-year</u> would rise under a shorter enlistment tour. This may seem paradoxical at first blush since, on average, three-year enlistees would serve for a shorter period of time at a lower rate of pay. The reason is that personnel costs for an NPS reservist are disproportionately high during the initial period of active duty for training, and shortening the period of enlistment means

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[1]These percentages refer either to a hypothetical force entirely maintained by NPS enlistments or that portion of the reserves made up of those men who entered as NPS enlistees. In the short run, both the ARNG and USAR have a sizable proportion of prior servicemen, and the ARNG has been able to maintain its strength during the past year by recruiting large numbers of veterans. However, both components should be aware of the long-term implications of shortening the term of enlistment, since the reserves cannot expect to enlist nearly so many prior servicemen in the future as they have during the last few years when large numbers of men were being separated from active duty.

that a larger proportion of each NPS reservist's service time is spent in that status.

On the average, new recruits are on active duty for training for about 5.5 months, during which time they receive about $2700 in pay and allowances. After training, they return to their home units and attend approximately 26 drills during the remainder of the year, receiving $12.11 per drill for a total of $315. Thus, their total pay for the first year runs about $3000. In the second year of service, those reservists who are promoted to grade E-3 receive $12.59 per drill for 63 drills (48 regular drills plus 15 days in summer camp) for a total of $793. As the men progress through the pay grades and accumulate years of service, their drill pay goes up about $50 per year on the average under current pay rates, reaching approximately $2000 in the 25th year for a Master Sergeant (E-8).[1] However, since few reservists stay after the initial six-year term, the pay and allowances during the first year of service are a significant portion of the total pay to reservists.

Table 11 gives the expected pay per reservist and per man-year under the three enlistment tours and for various reenlistment rates. Assuming a 25 percent reenlistment rate and the same yearly attrition rates as before, we see that the average pay per reservist under the three-, four-, and six-year terms is $6744, $7481, and $8899, respectively. Dividing these figures by the expected tour lengths under the three schemes gives the following expected values per man-year: 3-year: $1462, 4-year:$1402, 6-year:$1334. Thus, average pay per man-year runs 10 percent higher for the three-year enlistees and 5 percent higher for the four-year enlistees, even though they have a lower average experience level.

Thus far there has been little to recommend the shortened enlistment options, but an important aspect of the 3x3 and 4x2 schemes has been ignored--namely, that NPS enlistees who elect not to continue attending drills at the end of their three- or four-year tours are still members of the Individual Ready Reserve for the remainder of their

[1] For additional details, see Appendix D.

Table 11

EXPECTED PAY AND ALLOWANCES PER RESERVIST AND PER MAN-YEAR UNDER THREE-, FOUR-, AND SIX-YEAR INITIAL ENLISTMENT TOURS

Expected Total Pay per Reservist			
Reenlistment Rate	Initial Enlistment Tour		
	3 Years	4 Years	6 Years
0.10	5353	6138	7654
0.15	5817	6585	8069
0.20	6280	7033	8484
0.25	6744	7481	8899
0.30	7208	7928	9314
Expected Total Pay per Man-year			
0.10	1523	1426	1327
0.15	1499	1416	1329
0.20	1479	1408	1332
0.25	1462	1402	1334
0.30	1447	1395	1335

six-year terms. (See Appendix D.) Reservists in the IRR have received the same training as those in the regular Army and have gained additional military experience during their three or four years of reserve duty. Moreover, reservists serve without pay in the IRR, providing a large, fairly young pool of men that can be called into active duty in time of war or national emergency declared by Congress or the President. To what extent maintaining this pool of men justifies the many shortcomings of the shortened enlistment tours is beyond the scope of this report since it requires a careful analysis of the relative costs and tradeoffs in operational effectiveness.

Some Army officials have said that testing the 3x3 or 4x2 scheme does not test the effectiveness of a truly shortened enlistment tour--for example, a three-year tour with no IRR obligation. They would argue that 3x3 or 4x2 still adds up to a six-year commitment, and a truly shortened enlistment tour, say 3x0 or 4x0, would elicit much more of a response in NPS enlistments than was seen during the experiment. This may very well be the case, but the experimental results seem to point to the conclusion that shortening the enlistment tour does not seem to be all that important to new recruits, as is evidenced by the extremely successful recruiting campaigns and the number of recruits in 3x3 states who signed up for six years. Also, the only really positive thing to be said about the 3x3 and 4x2 options is that they would add men to the IRR, and this benefit would disappear entirely under a 3x0 or 4x0 scheme.

Others might contend that the first-term reenlistment rate for 3x3 and 4x2 enlistees would be much higher than that under a 6x0 scheme, in which case the increased expected tour lengths would offset some of the shortcomings discussed above. In support of this contention is the fact that a 3x3 enlistee still has a three-year commitment to serve in the IRR after completing his three years of unit participation. It is conceivable that some enlistees can be persuaded that, as long as they are subject to being called into service anyway, they might as well put in a few hours a month at the armory and get paid for it. Although the author places little faith in this argument, he has no way to refute it. However, another consideration in thinking about future reenlistment rates is that, other things equal, the 6x0 recruits would probably be more favorably disposed toward military service than the 3x3 cohort, because the six-year enlistees are willing to make a longer commitment to active reserve participation. In addition, a 6x0 man typically receives quite a bit more pay at the end of his six years than the 3x3 man does at the end of three, and the six-year man would probably build up a stronger attachment to his reserve unit. For these reasons, incentives and efforts geared to raising retention among the 3x3 enlistees would probably be more effective when applied to the 6x0 group. At any rate it seems unduly optimistic to assume that the 3x3 reenlistment rates would be appreciably higher than the 6x0 rates under the same reenlistment incentives. In fact, they may be somewhat lower.

As was indicated previously, the estimated response to the 4x2 option in increased NPS enlistments is close to that required to offset the man-year losses. In terms of expected tour lengths, man-year costs, and experience level of the force, the 4x2 scheme compares much more favorably with the current six-year term than the 3x3 scheme. Except for the fact that fewer men would flow into the IRR under the 4x2 option, the 4x2 scheme seems preferable to the 3x3 scheme in all respects. However, this should not be construed as a recommendation for implementing the 4x2 scheme. The advisability of shortening the enlistment tour depends upon many considerations related to the operational effectiveness of the reserves and the costs of alternative procurement methods.

Shortening the initial term of enlistment represents only one of many alternatives to be explored in devising a recruitment strategy for maintaining the reserves under zero-draft circumstances. The size and experience level of the reserve force depends not only on the number of enlistees but on the attrition and reenlistment rates, all of which are subject to change at varying costs. Instead of, or in addition to, shortening the initial tour of enlistment, the military can use enlistment bonuses and other incentives to increase the number of enlistments, or they can rely on varying levels and modes of recruiting activity. Reenlistment bonuses, increased pay, and other incentives can be used to raise reenlistment rates and cut attrition. There is no question that, with enough money and effort, the reserves can be manned at or above current levels. The problem is to find a cost-effective overall strategy that may involve several of the above activities. But it may not include shortening the enlistment term if alternative methods can yield the same size force at less cost.

The discussion above has concentrated primarily on the long term effects of adopting a shorter term of enlistment, but in the short run one must consider that the present force is far from being in a steady state, and the timing of policy changes become critical. For the most part the Army Reserve Components consist of draft-motivated men who joined the reserves during the Vietnam War, many of whom will complete their six years of service two to four years from now. Unless something is done to raise reenlistment rates, implementing a 3x3 scheme now may only contribute to the problems that the reserves will be facing three years from now when large numbers of the six-year men will be leaving the force.

As an indication of how unsteady the current state of the reserves is, Table 12 shows the number of NPS enlistments in the Army Reserve Components from 1966 to 1972.

Table 12

NONPRIOR SERVICE ENLISTMENTS,
ARMY RESERVE COMPONENTS,
FY 1966-FY 1972

Year	Nonprior Service Enlistments		
	ARNG	USAR	Total
FY 1966	109,939	62,037	171,976
FY 1967	45,113	28,400	73,513
FY 1968	23,726	17,684	41,410
FY 1969	43,096	48,511	91,607
FY 1970	104,464	44,459	148,923
FY 1971	52,425	30,175	82,600
FY 1972	46,853	15,529	62,382

SOURCE: Department of Defense, OASD (Comptroller), Directorate for Information Operations, Selected Manpower Statistics, April 15, 1973, p. 100.

During FY 1974, few NPS reservists reached the end of their six-year tours since the number of new recruits during FY 1968 was small, and this is one factor behind the ARNG's success in building their enlisted strength during the year. Another factor is that the ARNG has been able to recruit large numbers of prior servicemen upon separation from service, but this supply of manpower will also decline in the future. Given that large numbers of NPS reservists will be completing their six-year tours of duty in 1976 and 1977, it may be more advisable to take the money required to implement a three-year enlistment scheme and invest it in incentives and activities that would raise the reenlistment rate of the NPS enlistees currently in the reserves.

How far would implementing the 3x3 option go toward replacing the 100,000 or so men who will be leaving the reserves in FY 1976? To put the 100,000 figure in perspective under a zero-draft situation, in 1973 the Army Reserve Components had approximately 25,000 NPS enlistees, many of whom enlisted under the 3x3 or 4x2 options. Suppose that the number of NPS enlistments would have been 30 percent higher during the year if the 3x3 scheme had been implemented at the beginning of the year. This would represent a total of about 7500 men. Clearly, implementing the 3x3 or 4x2 scheme, by itself, can do little to solve the "reserve problem" and may even add to the difficulties facing the reserves later on.

To look at the total number of NPS enlistees in the reserves in another way, consider just the 18-year-old males in the population. According to Bureau of the Census estimates, there were 2,045,000 male 18-year-olds in the U.S. population on July 1, 1973.[1] Even if 40 percent of these men were either not qualified for military service or had already enlisted, this still leaves approximately 1.2 million 18-year-old men. Thus, the 25,000 NPS enlistees in the Army Reserve Components are only a tiny proportion of the eligible male population. Doubling enlistments from 25,000 to 50,000 men per year would still only

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[1]U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 511, January 1974.

amount to enlisting 4 percent of the eligible 18-year-olds. Since potential enlistees into the reserves may be atypical of college-age males, the overall recruitment strategy should be geared not to what we think the typical young man would respond to but to what attracts the potential reservists in the population. For this group, recruiting efforts and incentives other than a shorter enlistment term may yield greater dividends at lower cost.

This report has attempted to provide some of the pertinent information for deciding whether an overall recruiting strategy should include either a 3x3 or 4x2 initial tour of enlistment. It is regrettable that more data were not available to provide better information for weighing alternative recruiting strategies, but the Army's data collection system was not yet comprehensive enough to support a more detailed analysis. As an indication of what could have been done, consider the highly productive recruiting campaigns that were conducted in the ARNG. The effects of the known campaigns in certain states are estimated in Appendix B. If the Army had data on the number of recruiting man-days and other costs associated with these campaigns, the cost per recruit could have been estimated for these efforts. Were those campaigns cost-effective? There is no way of knowing without the data. It may have been more cost-effective to pay an enlistment bonus of $1000 per recruit or to hire 10 more full-time recruiters in those states for six months. Also, the experimental design could have incorporated different types and levels of advertising with careful monitoring of the results, perhaps to include surveys of new recruits in several states, to determine the cost-effectiveness of advertising efforts relative to other recruiting techniques.

V. THE STATISTICAL ANALYSIS

This section provides a more detailed analysis of the responses to the shortened enlistment options in the Army National Guard. The study is restricted to the ARNG, since some important variables were missing in the USAR data. Insofar as the analysis of the effectiveness of the options is concerned, the omission of the USAR data should not be critical since the USAR accounted for only 13 percent of the male accessions during the experimental period. Also, the overall enlistment rates for the 3x3, 4x2, and 6x0 groups in the USAR were approximately proportional to the corresponding rates in the ARNG.

The main problem is to determine the extent to which the differences in enlistment rates among the groups are attributable to differences in demographic and strength characteristics. The numbers of enlistments and the overall enlistment rates (male NPS enlistments per thousand authorized strength) in the three groups during the experimental period were as follows:

Group	No. of male NPS enlistments	Enlistment rate
3x3	3875 (4855)	28.3 (35.5)
4x2	2312 (2605)	27.8 (31.3)
6x0	2895 (3304)	18.7 (21.3)
All groups	9082 (10764)	24.2 (28.7)

The numbers in parentheses are from the raw data; the others are from the edited data. The editing process consisted of replacing the largest and smallest of the six monthly observations for each state by the next largest and next smallest. This was done to eliminate the effects of the highly productive recruiting campaigns that were conducted in certain states as well as to guard against large clerical errors in compiling the data.

On the face of it, the 3x3 group performed better than the 4x2 group, which in turn outperformed the control group by a wide margin. But as

Table 13 shows, the three groups differed on various strength and demographic characteristics. A comparison of the percentage deficits in strength indicates that the Army tended to offer the options in those states that were having trouble meeting their manning requirements before the experiment began. The experimental states were approximately 10 percent understrength overall at the start of the experiment, whereas the 6x0 states were less than 4 percent understrength. (The percentage deficits in strength for the individual states are given later in this section in Tables 14 and 15.) Another notable difference among the three groups is that on average the states in the 4x2 group had much higher enlistment rates during the six months before the experiment began. Thus, in the absence of the experimental options and other changes that affect recruiting performance, one would expect the 4x2 group to outperform the others during the last half of 1973.

In terms of demographic characteristics, the experimental states tended to be more populous and have higher incomes and educational attainment than the 6x0 states. An important imbalance among the groups insofar as analyzing the experiment is concerned is the lower unemployment rate among the 4x2 states during the experimental period. Since the enlistment rate seems to be sensitive to the level of unemployment, recruiters in the 4x2 states were operating under a handicap.

In recruiting effort, the three groups had approximately the same number of recruiters per thousand authorized strength, but the 3x3 and 4x2 groups had considerably more money to spend on recruiting activity.

Of the many factors indicated in the table, the three that appear to be most important in comparing the states' recruiting performances are (a) strength deficits, (b) preexperimental recruiting performances, and (c) unemployment rates. In general, one would expect that recruiters for Guard units that are either overstrength or close to being up to strength would be under less pressure to recruit, and they would probably tend to be more selective. Thus, one would expect that the states that were overstrength at the start of the

Table 13

DEMOGRAPHIC AND STRENGTH COMPARISONS
ARMY NATIONAL GUARD

Characteristic	Mean Value for States in Group 3x3	4x2	6x0
Authorized enlisted strength in thousands as of June 30, 1973 (STR)	8.6	6.4	6.7
Percentage deficit in enlisted strength as of June 30, 1973 (DEF)	10.1	9.8	3.7
Preexperimental enlistment rate January-June 1973 (PRE)	24.9	30.5	23.7
Recruiters per thousand authorized strength (RCT)	20.5	21.0	21.4
Direct recruiting obligations (in dollars)/authorized strength (COST)	19.5	17.7	14.9
Unemployment rate (UN)	4.3	3.7	4.5
College age (18-24) male population in hundreds of thousands (POP)	2.6	2.3	2.0
Median earnings of males, 16 and over, in thousands of dollars (INC)	7.4	7.1	7.0
Percentage of population in urban areas (URB)	72.1	60.1	60.6
Percentage of blacks among college-age males (BLCK)	10.3	14.7	11.5
Percentage of population in military service (MIL)	1.0	1.5	1.0
Percentage of high school graduates among males 16-21 not in school (EDUC)	59.1	60.1	55.1

experiment would have somewhat reduced enlistment rates during the experimental period.

This hypothesis is supported by Table 14, which shows the recruiting performances of the control group states ordered according to their deficits in strength at the beginning of the experiment. Note that the five 6x0 states that were more than 10 percent understrength at the beginning of the experiment showed a 13.8 percent increase in nonprior service enlistments during the second half of 1973, whereas the six states that were overstrength at the start showed a 46.5 percent decrease.[1] While there is considerable evidence to indicate that this decrease was not solely attributable to these states' overstrength status (see the discussion near the end of Section III), it is clear that the recruiting performances of the six overstrength 6x0 states were far below what they could have been,[2] and allowances for this factor must be made in comparing the recruiting performances of the experimental states with those in the control group.

Table 15 shows the corresponding data for the 3x3 and 4x2 states. It is noteworthy that the ten 3x3 states that were more than 10 percent understrength at the beginning of the experiment showed only a 6.2 percent increase in NPS enlistments during the second half of 1973, and the corresponding 4x2 group suffered a 20.9 percent decrease. Since it was this group of states that would supposedly benefit most from a shorter term of enlistment, these unimpressive performances relative to their preexperimental performances cast some doubt as to

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[1]The percentage changes cited here may be somewhat distorted for reasons given in footnote (b) to Table 14. However, comparisons of the percentage changes among states or groups of states are still meaningful since the state-by-state figures are all derived from the same data set, and there is no reason to suspect that any state's recruiting performance would be appreciably more distorted than any other.

[2]These states were also either overstrength or close to it during the first half of 1973, when their combined enlistment rate, 37.3, exceeded the overall ARNG average by 46 percent. Moreover, the two overstrength 3x3 states, Louisiana and New Mexico, had a combined enlistment rate of 61.5, which was more than double the rate in the other 3x3 states. (See Table 15.)

Table 14

RECRUITING PERFORMANCES OF THE CONTROL GROUP STATES
ARMY NATIONAL GUARD

State[a]	Number of male NPS enlistments[b] (and enlistment rate)			Unemployment rate[c]	
	Jan-June	July-Dec	% increase	Jan-June	July-Dec
		6x0 Group			
More than 10% understrength					
Wyoming (15.9)	31 (20.7)	34 (22.7)	9.7	4.0	2.8
Colorado (15.1)	21 (7.2)	12 (4.1)	-42.9	3.4	2.8
Alaska (14.4)	79 (37.8)	100 (47.8)	26.6	11.8	9.0
Minnesota (13.5)	185 (20.2)	196 (21.3)	5.9	5.4	4.0
New Hampshire (10.3)	18 (8.6)	38 (18.2)	111.1	4.1	3.7
	334 (18.8)	380 (21.4)	13.8	5.2	4.0
Less than 10% understrength					
New York (9.4)	165 (7.4)	341 (15.3)	106.7	5.3	4.7
Michigan (8.8)	115 (12.1)	176 (18.5)	53.0	7.3	6.4
South Dakota (6.1)	96 (29.1)	35 (10.6)	-63.5	3.8	2.7
Indiana (5.1)	281 (29.3)	445 (46.4)	58.4	3.9	3.5
Tennessee (5.0)	289 (29.0)	163 (16.3)	-43.6	3.4	2.6
Idaho (4.0)	84 (26.2)	28 (8.7)	-66.7	5.6	4.8
Montana (2.7)	42 (18.6)	24 (10.7)	-42.9	7.4	5.4
Kentucky (2.6)	144 (30.2)	77 (16.2)	-46.5	4.9	3.7
Iowa (2.1)	72 (9.9)	77 (10.6)	6.9	3.3	2.4
Vermont (2.0)	106 (40.8)	69 (26.5)	-34.9	6.2	4.5
Utah (1.6)	75 (17.6)	56 (13.1)	-25.3	6.1	4.8
Illinois (0.4)	94 (8.9)	77 (7.3)	-18.1	4.1	3.3
	1563 (17.4)	1568 (17.5)	0.3	5.0	4.2
Overstrength					
Georgia (+0.3)	170 (20.2)	186 (22.2)	9.4	3.9	3.7
Maine (+0.4)	49 (18.5)	14 (5.3)	-71.4	7.2	5.2
Oklahoma (+3.0)	492 (61.2)	150 (18.7)	-69.5	4.5	3.8
Arkansas (+3.6)	214 (28.7)	112 (15.0)	-47.7	4.7	3.6
Alabama (+4.0)	449 (30.9)	268 (18.4)	-40.3	4.4	3.9
Puerto Rico (+4.9)	395 (62.1)	217 (34.1)	-45.1	11.2	13.3
	1769 (37.3)	947 (20.0)	-46.5	5.6	5.4
Total	3666 (23.7)	2895 (18.7)	-21.0	5.2	4.5

[a]The figures in parentheses following the state names are the percentage deficits in enlisted strength as of the beginning of the experiment.

[b]The numbers of enlistments are taken from the edited data, both for the experimental period (July-December) and for the first six months of 1973, to eliminate the effects of extensive recruiting campaigns during a single month and to guard against gross recording errors. The corresponding enlistment rates computed from the raw data are given in Table C.1 of Appendix C. The January-June data contain a small number of women, and different data gathering systems were used during the two periods, so that comparisons between periods may be somewhat distorted.

[c]See Appendix A.

Table 15

RECRUITING PERFORMANCES OF THE EXPERIMENTAL GROUP STATES
ARMY NATIONAL GUARD

State[a]	Number of male NPS enlistments[b] (and enlistment rate) Jan-June	July-Dec	% increase	Unemployment rate[c] Jan-June	July-Dec
3x3 Group					
More than 10% understrength					
Connecticut (19.9)	147 (26.6)	172 (31.1)	17.0	5.8	5.3
Washington (19.1)	309 (53.7)	224 (38.9)	-27.5	8.2	6.9
Massachusetts (15.6)	225 (16.3)	311 (22.6)	38.2	7.2	6.4
Rhode Island (14.2)	35 (11.9)	76 (25.9)	117.1	6.3	6.0
Hawaii (13.1)	128 (38.4)	46 (13.8)	-64.1	5.6	5.6
Pennsylvania (12.1)	231 (13.9)	323 (19.4)	39.8	4.8	3.9
Wisconsin (12.0)	134 (14.5)	60 (6.5)	-55.2	5.1	3.8
Texas (11.1)	344 (21.7)	481 (30.3)	39.8	3.2	2.9
Oregon (10.9)	334 (56.7)	210 (35.6)	-37.1	5.5	4.8
Ohio (10.2)	182 (12.9)	294 (20.9)	61.5	3.8	3.1
	2069 (22.2)	2197 (23.6)	6.2	4.9	4.2
Less than 10% understrength					
West Virginia (8.7)	87 (28.7)	59 (19.5)	-32.2	6.7	5.2
New Jersey (7.6)	292 (22.3)	581 (44.3)	99.0	7.3	6.3
Florida (5.1)	157 (20.6)	171 (22.4)	8.9	2.0	2.1
Mississippi (0.7)	218 (23.1)	221 (23.5)	1.4	4.3	3.6
	754 (22.7)	1032 (31.1)	36.9	4.8	4.2
Overstrength					
Louisiana (+0.4)	396 (53.2)	511 (68.6)	29.0	6.4	5.3
New Mexico (+2.8)	180 (58.9)	135 (44.2)	-25.0	6.2	5.4
	576 (54.9)	646 (61.5)	12.2	6.4	5.3
Total	3399 (24.9)	3875 (28.3)	14.0	5.0	4.3
4x2 Group					
More than 10% understrength					
Dist. of Columbia (21.4)	58 (28.0)	48 (23.1)	-17.2	2.9	3.0
Nevada (15.4)	89 (69.7)	50 (39.2)	-43.8	6.3	5.3
Nebraska (14.7)	84 (20.7)	27 (6.6)	-67.9	3.6	2.7
California (13.3)	946 (46.2)	698 (34.1)	-26.2	5.7	4.6
Maryland (12.6)	357 (57.5)	362 (58.3)	1.4	4.4	3.7
Delaware (11.9)	77 (31.4)	55 (22.4)	-28.6	4.4	4.4
Kansas (11.4)	185 (26.8)	180 (26.1)	- 2.7	3.5	2.8
	1796 (41.3)	1420 (32.7)	-20.9	5.2	4.2
Less than 10% understrength					
South Carolina (9.2)	186 (20.1)	177 (19.1)	- 4.8	3.8	3.5
North Dakota (7.5)	36 (15.9)	37 (16.4)	2.8	5.7	3.9
North Carolina (5.2)	237 (23.9)	324 (32.6)	36.7	2.8	2.2
Missouri (5.1)	120 (14.6)	125 (15.2)	4.2	4.5	3.6
Virginia (4.4)	41 (5.6)	155 (21.2)	278.0	2.7	2.4
Arizona (2.1)	119 (44.0)	74 (27.3)	-37.8	3.7	3.4
	739 (18.6)	892 (22.5)	20.7	3.4	2.9
Total	2535 (30.5)	2312 (27.8)	- 8.8	4.5	3.7

NOTES: Same as Table 13.

whether either of the shorter enlistment options would contribute substantially toward cutting the strength deficits in those states that are having the most difficulty meeting their manpower requirements.

On the other hand, the performances of the 4x2 states in this group during the second half of 1973 were poor only by comparison with their preexperimental performances. The overall enlistment rate for the 4x2 states that were more than 10 percent understrength was 32.7, which exceeded the performance of the corresponding 6x0 group by 53 percent. This raises the question as to whether the drop in recruiting performance in the 4x2 group during the experimental period was merely attributable to "regression to the mean," i.e., the tendency of very high performers during one period to perform closer to the mean during a later period. This phenomenon is common in situations where there is considerable variability in performance between periods, and Tables 14 and 15 clearly show this to be the case in this experiment. As a group, those states that had enlistment rates above 40 showed a 28 percent drop in enlistments during the second half of 1973.

California is one of the 4x2 states that had a sizable drop in enlistment rates during the last half of 1973, and its performance carries a lot of weight in the overall performance measures for the 4x2 group. Among the states having populations over 10 million, California had the highest enlistment rate, 46.2, in the first half of 1973, and although its rate dropped to 34.1 during the experimental period, it still exceeded that of the other most populous states: New York (15.3), Pennsylvania (19.4), Texas (30.3), Illinois (7.3), and Ohio (20.9). Three of these states (Texas, Pennsylvania, and Ohio) offered the 3x3 option; the others were in the control group.

California had a substantial drop in unemployment during the latter half of 1973, and this was probably a factor behind the reduction in California's enlistment rate during the experimental period. A comparison of the other states' enlistment and unemployment rates in Tables 14 and 15 indicates that enlistment rates may be sensitive to changes in the unemployment rates. With few exceptions those states that had high unemployment rates in 1973 also had high enlistment rates. Also, with the rise in the national unemployment rates in the early part of 1974, there was a corresponding rise in enlistment rates in all the reserve components.[1]

To allow for differences among the states in demographic and strength characteristics in comparing the recruiting performances of the three groups, multiple regression was used to estimate the effects of the options. The forms of the equations that were fitted were chosen based upon the assumption that, if all other factors associated with the recruiting process were held constant, each of the options would have the same multiplicative effect upon the enlistment rates in the states offering that option. If N_{ij} denotes the number of male enlistments during the experimental period in the j^{th} state in the i^{th} group (i = 1, 2, and 3 to correspond to the 3x3, 4x2, and 6x0 groups), this amounts to saying that

$$E(N_{ij}) = \gamma_i f(C_{ij}), \tag{1}$$

where $E(N_{ij})$ denotes the expected value of N_{ij}, γ_1 and γ_2 are the effects of the 3x3 and 4x2 options (assuming that $\gamma_3 = 1$), and $f(C_{ij})$ represents some unknown function of the state's strength and demographic characteristics C_{ij}. Since the primary purpose of the analysis is to estimate the γ_i's and since one would expect that the demographic and strength characteristics listed in Table 13 would affect the number of enlistments multiplicatively rather than additively, one is led to consider the logarithms of the counts N_{ij} (or of the corresponding enlistment rates) with the thought of transforming the problem from one of estimating the multiplicative effects γ_i to one of estimating additive effects $\beta_i = \log \gamma_i$.

The methodology used for estimating the β_i's consisted of fitting linear equations of the form

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[1]The unemployment rate for males, 16 and over, jumped from 4.0 percent in December 1973 to 5.1 percent in January 1974 and 5.3 percent in February (U.S. Department of Labor, Employment and Earnings, Vol. 20, No. 11, May 1974, p. 19). The number of NPS enlistments in the reserve components rose from 3262 in December 1973 to 4689 in January and 5288 in February.

$$\text{(2)} \qquad \text{LRATE} = \beta_0 + \beta_1 I^{3x3} + \beta_2 I^{4x2} + \textstyle\sum_{j=3}^{p} \beta_j X_j$$

where LRATE is the logarithm of the enlistment rate for each state, I^{3x3} and I^{4x2} are dummy variables having values 1 or 0 to indicate the 3x3 and 4x2 states, and the other independent variables X_j are functions of POP, INC, and the other variables defined in Table 13. The regression coefficients β_j were estimated by weighted least squares using the numbers of enlistments N_{ij} as weights. This methodology was motivated by an analysis of the preexperimental enlistment data and by certain theoretical considerations that will be outlined below. The reader who is not interested in the statistical details may wish to skip to the fitted equations, beginning with equation (6).

Given the nature of the enlistment counts N_{ij}, one can assume that they are independent random variables having approximately Poisson distributions[1] with means λ_{ij} that depend on the state characteristics C_{ij} as well as the option effects γ_i. We analyze below the logarithms of both the N_{ij}'s and the enlistment rates $\text{RATE}_{ij} = N_{ij}/\text{STR}_{ij}$. In general if N has a Poisson distribution with parameter λ and if λ is not too small (say, $\lambda > 5$), then for any positive constant c, the transformed variable log (N/c) has expectation approximately equal to log (λ/c), and its variance is approximately equal to $1/\lambda$.[2] Thus, if λ is a product of factors of the form $z_j^{\beta_j}$, then E[log (N/c)] is

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[1] A random variable N is said to have a Poisson distribution with parameter λ if the probability function of N is given by $P(N=k) = e^{-\lambda}\lambda^k/k!$ for k = 0, 1, 2, ... For technical discussions indicating why distributions of counts of random occurrences are often well fitted by the Poisson distribution, see Emanuel Parzen, Stochastic Processes, Holden-Day, San Francisco, 1962, pp. 118-139; also J. L. Hodges, Jr. and Lucien LeCam, "The Poisson Approximation to the Poisson Binomial Distribution," Annals of Mathematical Statistics, Vol. 31, September 1960, pp. 737-740.

[2] D. R. Cox, "Some Statistical Methods Connected with Series of Events," Journal of the Royal Statistical Society (Series B), Vol. 27, No. 2, 1955, pp. 129-157. Cox's work would suggest the use of the transformed variable log [(N + 1/2)/c] for small values of N in lieu of log (N/c), but in our case the values of N are all 12 or more, so that this minor refinement can be ignored, except to specify the value of log (N/c) when N = 0.

approximately a sum of terms of the form $\beta_j \log z_j$, and the variance of log (N/c) can be estimated approximately by 1/N.

The decision to use the logarithm of the enlistment rate as the dependent variable in (2) rather than log N or the logarithm of N/POP was based on the analysis of the preexperimental data. Let N_p denote the number of NPS enlistments during January-June 1973, according to the edited data provided in Tables 14 and 15, and let LN_p denote the logarithm of N_p. Then an equation that fits the preexperimental data quite well is:[1]

$$(3) \qquad \begin{aligned} LN_p = & \underset{(3.50)}{-0.43} + \underset{(0.27)}{1.03}\ LSTR - \underset{(0.20)}{0.09}\ LPOP - \underset{(0.75)}{0.10}\ LINC \\ & + \underset{(0.38)}{0.52}\ LURB + \underset{(0.24)}{0.67}\ LUN_p - \underset{(0.13)}{0.10}\ LBLCK - \underset{(0.08)}{0.01}\ LMIL \\ & + \underset{(1.02)}{0.28}\ LEDUC - \underset{(0.23)}{0.93}\ NE - \underset{(0.22)}{0.63}\ NC + \underset{(0.26)}{0.20}\ SO, \end{aligned}$$

where the variables LSTR, LPOP, ..., are the logarithms of the variables STR, POP, ..., defined in Table 13, and NE, NC, and SO are indicator (dummy) variables for regions of the country--Northeast, North Central, and South. Note that the regression coefficient on LSTR is very close to unity, indicating that the number of enlistments is approximately proportional to the authorized strength, whereas the coefficient on LPOP is not even statistically significant. This dependence of the number of enlistments on the authorized strength persisted in other fitted equations, both for the experimental period and the preexperimental period. For example, if the statistically nonsignificant variables LBLCK, LMIL, and LEDUC are omitted from equation (3), the fitted equation becomes

$$(4) \qquad \begin{aligned} LN_p = & \underset{(1.72)}{0.58} + \underset{(0.23)}{1.07}\ LSTR - \underset{(0.17)}{0.16}\ LPOP + \underset{(0.36)}{0.82}\ LINC + \underset{(0.37)}{0.44}\ LURB \\ & + \underset{(0.21)}{0.64}\ LUN_p - \underset{(0.20)}{0.95}\ NE - \underset{(0.20)}{0.64}\ NC + \underset{(0.20)}{0.01}\ SO. \end{aligned}$$

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[1] Equation (3) was fitted by weighted least squares using the values of N_p as weights. The values in parentheses beneath the

There are several observations to be made about equations (3) and (4) above and other equations that were fitted to the preexperimental data:

(a) The use of the enlistment rate or its logarithm, instead of N/POP or its logarithm, is justified by the nearness of the coefficients on LSTR to 1.0 and the lack of statistical significance of the coefficients on LPOP. Nevertheless, in fitting equations of the form (2) to the data for experimental period, the logarithm of POP/STR was used as an independent variable so that the possible joint dependence of the number of enlistments on STR and POP would not be overlooked.

(b) The only variables, other than LSTR, that were statistically significant in both (3) and (4) were the unemployment rates UN_{PRE} and the regional indicators NE and NC. The dependence of the enlistment rates on the unemployment rates is strong and, as will be seen later, persists into the experimental period. The highly significant differences in enlistment rates across regions, even after accounting for differences among the states in income, unemployment rates, percentages of blacks, educational indices, and percentage of rural population, is a peculiarity that is hard to explain. Apparently the regional indicators act as proxies for other variables such as amount of recruiting effort, public esteem for the military, regard for the Guard unit as a social club, climate, etc. At any rate, these rather meaningless indicator variables account for more of the variability among the states' enlistment rates than other more meaningful variables, such as income, percentage of the population in urban areas, and percentage of military population, and they will be used below as control variables in analyzing the experimental data.

(c) Although variables to capture the possible dependence of the enlistment rates on the states' deficits in strength are not included in equations (3) and (4), other equations using different specifications for the dependence revealed virtually no relationship between these variables during the preexperimental period.

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regression coefficients are the standard errors of the estimates. One measure of the goodness of fit of the regression equation is the square of the multiple correlation coefficient, R^2, which in this case was 0.76.

(d) The multiplicative models (3) and (4) fit appreciably better than the corresponding additive models using either the enlistment rate or the number of enlistments as the dependent variable. Also, changing the multiplicative model by using other specifications of the independent variables does not appreciably improve the fit. There seems to be a lot of unexplained variability in the states' preexperimental enlistment rates--far more than one can attribute to the randomness in the counts. This unexplained variability may very well mask important variables closely related to recruiting performance. Therefore, a measure of the extent to which each state's enlistment rate exceeded or fell below what would have been anticipated on the basis of its demographic characteristics was used as an additional control variable in analyzing the data for the experimental period. The measure used was the residual in the fitted equation

$$(5)\quad \underset{(1.32)}{\mathrm{LPRE} = 2.00} + \underset{(0.28)}{0.15\ \mathrm{LURB}} + \underset{(0.19)}{0.65\ \mathrm{LUN}_p} - \underset{(0.19)}{0.96\ \mathrm{NE}} - \underset{(0.19)}{0.67\ \mathrm{NC}} - \underset{(0.16)}{0.04\ \mathrm{SO}}$$

where LPRE is the logarithm of the preexperimental enlistment rates PRE given in Tables 14 and 15. This equation, again fitted by weighted least squares, accounts for 54 percent of the variability in LPRE across states.[1] The residual from this equation, which for each state is the difference between the actual value of LPRE and its fitted value according to (5), will be denoted below by LPRE*. As we shall see, it turns out to be a highly significant variable in explaining differences in recruiting performances across states during the experimental period, indicating that there is a carry-over effect between the two periods that is not accounted for by the many other factors that are included in the fitted equations.

To estimate the effects of the 3x3 and 4x2 options, equations of the form (2) were fitted to the data. An equation that contains most of the variables that were considered and accounts for 70 percent of the variability in the enlistment rates across states is:

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[1]Including four other variables LINC, LBLCK, LMIL, and LEDUC in the equation only raises R^2 to 58 percent, and none of these four comes close to being statistically significant in the resulting equation.

$$\text{(6)} \quad \begin{aligned} LRATE = \underset{(3.19)}{7.24} &+ \underset{(0.14)}{0.26}\, I^{3x3} + \underset{(0.18)}{0.17}\, I^{4x2} + \underset{(0.21)}{0.49}\, LUN + \underset{(0.70)}{1.38}\, LINC \\ &- \underset{(0.33)}{0.21}\, LURB + \underset{(0.10)}{0.02}\, LBLCK + \underset{(0.06)}{0.05}\, LMIL - \underset{(0.94)}{1.58}\, LEDUC \\ &+ \underset{(0.12)}{0.68}\, LPRE^* + \underset{(0.18)}{0.11}\, LP/S + \underset{(0.64)}{0.63}\, LPRS - \underset{(0.19)}{0.27}\, NE \\ &- \underset{(0.19)}{0.10}\, NC + \underset{(0.23)}{0.11}\, SO \end{aligned}$$

where

(a) LUN, LINC, ..., LEDUC are the logarithms of the variables UN, INC, ..., EDUC defined in Table 13;

(b) LPRE* is defined in the previous paragraph;[1]

(c) LP/S is the logarithm of the ratio POP/STR, a measure of the population size relative to the authorized strength of the Guard units in that state;

(d) NE, NC, and SO are regional indicators (Northeast, North Central, and South);

(e) LPRS is the logarithm of a variable PRS (for "pressure") to measure the effect on recruiting performance of being overstrength or close to it. This measure, motivated by an examination of the recruiting performances in the 6x0 states (see Table 14), is defined by

$$PRS = \frac{1}{1 + e^{-50(1.05 - r)}}$$

where r is the ratio of the actual enlisted strength to the authorized strength at the start of the experiment. The graph of PRS as a function of r is indicated in Fig. 5. The inclusion of LPRS in (6) amounts to assuming that, other things being equal, the functional dependence of the enlistment rates on r can be approximated by some power of PRS.

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[1] If LPRE is used in lieu of the residual LPRE* in (6), the regression coefficients on I^{3x3} and I^{4x2} are changed hardly at all--from 0.26 and 0.17 to 0.27 and 0.18. However, the values of the other regression coefficients become distorted since the preexperimental rates also depend on the demographic and strength characteristics that are included in the equation.

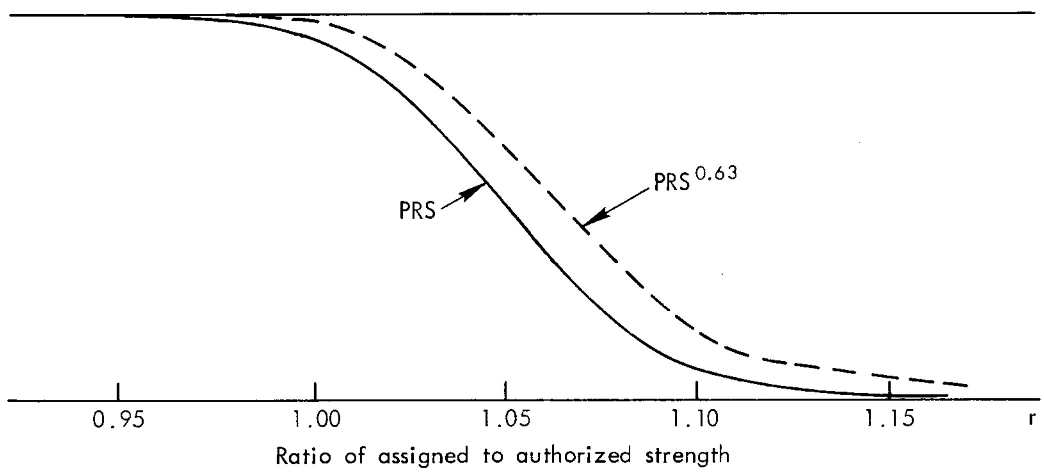

Fig. 5— PRS as a function of r

According to (6), that approximate relationship is given by RATE $= \mathrm{PRS}^{0.63}$ (see Fig. 5).

The regression coefficients on I^{3x3} and I^{4x2} are $\hat{\beta}_1 = 0.26$ and $\hat{\beta}_2 = 0.17$, so that the corresponding estimates of the option effects are $\hat{\gamma}_1 = e^{0.26} = 1.30$ and $\hat{\gamma}_2 = e^{0.17} = 1.19$. That is, according to (6) the estimated overall effects of the 3x3 and 4x2 options were to raise the enlistment rates in the 3x3 and 4x2 groups by approximately 30 and 19 percent respectively. Equation (6) was the basis for the rough estimates of the option effects given in Section III. As the standard errors of $\hat{\beta}_1$ and $\hat{\beta}_2$ indicate, both of these estimates should be treated as being rather imprecise. Also, as we shall see, the estimates of the option effects are somewhat sensitive to alternative specifications of the fitted equation.

Equation (6) contains a number of variables that are not statistically significant.[1] If one eliminates the regional indicator variables, the resulting equation is:

$$\text{(7)}\quad \underset{}{\text{LRATE}} = \underset{(2.74)}{8.26} + \underset{(0.13)}{0.26}\, I^{3x3} + \underset{(0.18)}{0.15}\, I^{4x2} + \underset{(0.18)}{0.38}\, \text{LUN}$$

$$+ \underset{(0.70)}{1.23}\, \text{LINC} - \underset{(0.32)}{0.36}\, \text{LURB} + \underset{(0.10)}{0.04}\, \text{LBLCK} + \underset{(0.05)}{0.10}\, \text{LMIL}$$

$$- \underset{(0.86)}{1.55}\, \text{LEDUC} + \underset{(0.12)}{0.70}\, \text{LPRE*} + \underset{(0.16)}{0.19}\, \text{LP/S} + \underset{(0.62)}{0.32}\, \text{LPRS}.$$

Omitting the statistically nonsignificant variables LINC, LBLCK, and LP/S gives:

$$\text{(8)}\quad \text{LRATE} = \underset{(1.64)}{6.12} + \underset{(0.13)}{0.16}\, I^{3x3} + \underset{(0.17)}{0.09}\, I^{4x2} + \underset{(0.15)}{0.43}\, \text{LUN} + \underset{(0.26)}{0.25}\, \text{LURB}$$

$$+ \underset{(0.05)}{0.12}\, \text{LMIL} - \underset{(0.39)}{1.08}\, \text{LEDUC} + \underset{(0.12)}{0.70}\, \text{LPRE*} + \underset{(0.53)}{1.31}\, \text{LPRS}.$$

Alternatively, if the regional variables are included and some of the other nonsignificant variables in (6) are omitted, the fitted equation becomes:

$$\text{(9)}\quad \text{LRATE} = \underset{(0.33)}{2.11} + \underset{(0.13)}{0.20}\, I^{3x3} + \underset{(0.15)}{0.19}\, I^{4x2} + \underset{(0.19)}{0.76}\, \text{LUN} + \underset{(0.12)}{0.64}\, \text{LPRE*}$$

$$+ \underset{(0.49)}{1.32}\, \text{LPRS} - \underset{(0.16)}{0.22}\, \text{NE} - \underset{(0.18)}{0.06}\, \text{NC} + \underset{(0.16)}{0.37}\, \text{SO}.$$

Some readers may question the inclusion of the logarithm of PRS in equations (6)-(9) as a means of controlling for differences in strength deficits, because the variable PRS may not capture the relationship between enlistment rates and deficits in strength perfectly,

[1]Only the constant term and two regression coefficients are statistically significant at the 5 percent level, namely, those on LUN and LPRE*, for which the t-statistics are 2.3 and 5.7 respectively. But equation (6) is overburdened with variables that are closely related, and some of the other variables (LMIL, LEDUC, LPRS, and SO) become statistically significant under alternative specifications.

and the analysis may be sensitive to misspecification along these lines since there are substantial differences among the three groups in this variable.[1] Also, the apparent dependence of enlistment rates upon deficits in strength does not seem to be the same in the three groups. See Tables 14 and 15.

The principal reason for including the variable PRS in the analysis was to make allowances for the below par performances in the overstrength states. But a second method for achieving the same end is to simply eliminate the overstrength states from the analysis. This does not reduce the sample size appreciably. Only two experimental states, Louisiana and New Mexico, were overstrength at the start of the experiment, and both were 3x3 states. In the control group, Georgia, Maine, Oklahoma, Arkansas, Alabama, and Puerto Rico were all overstrength, but there were 17 other 6x0 states. Moreover, deleting the overstrength states and Puerto Rico from the analysis results in considerably more balance among the three groups. The resulting equation, incorporating all the control variables except LPRS that were included in (6), is

$$
\begin{aligned}
(10)\qquad \text{LRATE} = {} & \underset{(3.54)}{5.19} + \underset{(0.14)}{0.15}\ I^{3x3} + \underset{(0.18)}{0.11}\ I^{4x2} + \underset{(0.27)}{0.12}\ \text{LUN} \\
& + \underset{(0.79)}{2.03}\ \text{LINC} - \underset{(0.31)}{0.28}\ \text{LURB} + \underset{(0.10)}{0.02}\ \text{LBLCK} + \underset{(0.06)}{0.07}\ \text{LMIL} \\
& - \underset{(1.01)}{1.21}\ \text{LEDUC} + \underset{(0.11)}{0.64}\ \text{LPRE*} + \underset{(0.18)}{0.02}\ \text{LP/S} - \underset{(0.16)}{0.12}\ \text{NE} \\
& - \underset{(0.17)}{0.15}\ \text{NC} + \underset{(0.24)}{0.14}\ \text{SO}.
\end{aligned}
$$

The equation that corresponds to (9) is

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[1] To see that this is a critical aspect of the analysis, if the variable LPRS had been omitted from equation (9), the resulting equation would have been

$$
\begin{aligned}
\text{LRATE} = {} & \underset{(0.34)}{2.36} + \underset{(0.13)}{0.34}\ I^{3x3} + \underset{(0.15)}{0.34}\ I^{4x2} + \underset{(0.17)}{0.51}\ \text{LUN} \\
& + \underset{(0.13)}{0.58}\ \text{LPRE*} - \underset{(0.17)}{0.16}\ \text{NE} - \underset{(0.19)}{0.06}\ \text{NC} + \underset{(0.16)}{0.18}\ \text{SO}.
\end{aligned}
$$

$$\text{(11)} \quad \text{LRATE} = \underset{(0.38)}{2.36} + \underset{(0.13)}{0.08}\ I^{3x3} + \underset{(0.14)}{0.17}\ I^{4x2} + \underset{(0.21)}{0.61}\ \text{LUN}$$

$$+ \underset{(0.11)}{0.64}\ \text{LPRE*} - \underset{(0.15)}{0.12}\ \text{NE} - \underset{(0.18)}{0.10}\ \text{NC} + \underset{(0.18)}{0.03}\ \text{SO}.$$

A comparison of these equations with (6) and (9) shows that deleting the overstrength states and Puerto Rico from the analysis results in somewhat lower estimates of the effects of the options. This tends to confirm the observation made earlier that the shortened enlistment options had less effect on enlistment rates in those states that would supposedly benefit most from the options.

Equations (6)-(9) make no allowances for differences among the states in recruiting effort. Although there were hardly any differences among the three groups in numbers of recruiters assigned per thousand authorized strength (RCT), there were substantial differences in allocations for recruiting per thousand authorized strength (COST). See Table 13. One can easily include RCT and COST as independent variables in the fitted equation, as will be done below, but there are two problems in interpreting the results. First, the number of recruiters was approximately proportional to the authorized strength, and allowances for differences in authorized strengths were implicitly made by using the enlistment rate rather than the numbers of enlistment as the independent variable. Second, the edited data was used to eliminate some of the differences in recruiting effort among states, and it may have been the case that the states that had the most productive recruiting campaigns were those which put forth most of their recruiting effort and expenditures during that single month. Therefore, it appears unduly optimistic to hope that including the variables RCT and COST in the fitted variables will make proper allowances for differences in recruiting effort and therefore yield better estimates of the effects of the options. Nor can one interpret the regression coefficients on RCT and COST literally. For what it is worth, the equation that corresponds to (9) with the logarithms of RCT and COST added to the equation is

$$(12) \qquad \underset{}{LRATE} = \underset{(1.46)}{3.14} + \underset{(0.14)}{0.14}\, I^{3x3} + \underset{(0.16)}{0.16}\, I^{4x2} + \underset{(0.21)}{0.65}\, LUN$$

$$+ \underset{(0.12)}{0.62}\, LPRE^{*} + \underset{(0.51)}{1.19}\, LPRS - \underset{(0.17)}{0.22}\, NE - \underset{(0.18)}{0.07}\, NC$$

$$+ \underset{(0.17)}{0.34}\, SO - \underset{(0.46)}{0.43}\, LRCT + \underset{(0.16)}{0.16}\, LCOST.$$

Although neither of the regression coefficients on LRCT or LCOST is statistically significant, it is interesting to note that the inclusion of these variables tends to reduce the estimates of the option effects.

In summary, the estimated values of β_1, the coefficient on the indicator variable for the 3x3 states, in (6)-(9) range from 0.16 to 0.26, yielding estimates of the overall multiplicative effect of the 3x3 option of between $e^{0.16} = 1.17$ and $e^{0.26} = 1.30$. Equations (10) and (11), which include the overstrength states, yield slightly lower estimates of the 3x3 effect.[1] The corresponding estimates of the multiplicative effect for the 4x2 option range from 1.09 to 1.21. The conclusion in Section III that the 3x3 and 4x2 options resulted in 20-40 and 10-30 percent increases in NPS enlistments was based primarily upon (6), which contains all the independent variables that were included in the analysis that seemed to be closely associated with enlistment rates.

As a footnote to the analysis, the author feels obliged to point out that he has surely exceeded the bounds of ordinary statistical practice by presenting as intricate an appraisal of the options as was carried out here. As the next section will show, the experiment had many flaws that may have prejudiced the findings, and the validity of the data is suspect. Even if these doubts could be dispelled, the analysis, despite its intricacies, failed to explain satisfactorily the tremendous amount of variability in enlistment rates across states and between time periods within states.

A detailed examination of the accessions data for neighboring

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[1]The main reason for this is that excluding the overstrength states eliminates Louisiana's outstanding recruiting performance.

pairs of states that belong to the same experimental group and have similar strength and demographic characteristics (e.g., Colorado and Wyoming, Indiana and Illinois, Louisiana and Mississippi) shows remarkable differences in recruiting performances, whether one gauges recruiting performance using (a) the enlistment rate, (b) a rate using the size of the college-age population as a base, (c) a rate using the number of recruiters as a base, or (d) residuals from fitted equations that incorporate several variables simultaneously. This suggests that there may be some important factor missing in the analysis that would explain some of this variability. The same factor, if it exists, might explain the fact that, in many states, the month-to-month variability in the number of enlistments far exceeds what one would expect from month-to-month changes in strength deficits, job opportunities within the state, seasonal factors, and random fluctuations.[1]

The author conjectures that the wide variability in enlistment rates among states and between time periods within states may be attributable in part to differences in the amount of pressure that the state ARNG commanders (or other officials at the state level) exert on the unit commanders and recruiters to stimulate their recruiting activities. Just as intensive recruiting campaigns during a single month can be extremely productive, a continual effort by a state commander to have the company-level commanders give high priority to their recruiting activities may produce substantial results. Differences in efforts to promote recruiting activity at the state level may account for some of the differences in recruiting performances between neighboring states having similar characteristics. Since these efforts to stimulate recruiting at the state level may last for several months and vary in intensity over time, this would also help to explain some of the variability in recruiting performances between time periods.

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[1]In considering the magnitudes of the random fluctuations, it seems plausible to assume that the monthly enlistment counts should follow (at least approximately) a non-homogeneous Poisson process with an intensity function that depends upon various factors that change over time, such as recruiting effort, unemployment rates, strength deficits, etc. See Emanuel Parzen, Stochastic Processes, Holden-Day, Inc., San Francisco, 1962, Chapter 4, for definitions of these terms.

What does this have to do with analyzing the shorter enlistment options? If the ARNG commanders in the experimental states were making special efforts to stimulate their recruiting activities during the experimental period (perhaps to show how effective the options would be once they were implemented), the estimated responses to the enlistment options may have been distorted. This factor, in conjunction with the subpar performances of the 6x0 states, may have led to our overestimating the responses to the 3x3 and 4x2 options.

In conclusion, the reader should not be misled by the implied precision of the estimates of the responses given above, namely, 20-40 percent for the 3x3 option and 10-30 percent for the 4x2 option. They merely represent a range of point estimates resulting from various methods of adjusting for the inequities among the three groups of states. But these estimates may have been distorted by various factors. For what it is worth, the author is much more confident about the upper bounds on these intervals than the lower bounds.

VI. CRITIQUE OF THE EXPERIMENT

The primary purpose of the variable tour experiment was to provide information on the advisability of changing from a six-year initial enlistment tour in the Army Reserve Components to a shorter tour, perhaps to be followed by a period in the Individual Ready Reserve. The test was partially successful in that it provided rough estimates of the effects of the shorter enlistment options as well as other information about the recruiting process that the Army may find useful. However, the experiment had certain shortcomings, both in design and in execution, that not only made the experiment less informative than it could have been but jeopardized the credibility of the experimental results.

Several Army officials expressed doubt as to whether the experiment would provide a fair appraisal of the shorter enlistment options. In a critique of the experiment written while it was still in progress, Colonel Robert S. Young, Chief, Manpower Systems Division, Office of the Assistant Secretary of the Army (M&RA), wrote, "The ongoing test will not prove anything about the effectiveness of the 3x3 and 4x2 enlistments vis-à-vis the 6x0 enlistment."[1] Colonel Young's views on the experiment merit special consideration. He is knowledgeable about the reserve recruiting process, and he knows the hazards of statistical analysis in partially controlled experiments. While the author does not share all of Colonel Young's views, many of his criticisms of the test are well-founded and will be cited below.

How _should_ the experiment have been designed? Colonel Young's critique contains a section spelling out the guidelines that he would have used:

> Although there are many interesting independent variables that possibly should be considered, the following are the ones on which there would be general agreement as having

[1] Colonel Robert S. Young, "Analysis of the Army's Ongoing Reserve Enlistment Test," Office of the Assistant Secretary of the Army (M&RA), September 1973.

major influence on the number of enlistments any unit obtains:

- Quantitative and qualitative need for people.

- Size of the eligible manpower pool to fill the need.

- Amount of information and persuasion targeted on the members of the eligible manpower pool.

- Tendency of the members of the eligible manpower pool to enlist.

- Variance in tendency to enlist during certain times of the year.

The test design should stratify all Reserve Component units in terms of these five variables. Units would be considered to be in the same homogeneous group that reasonably have approximately the same need to obtain approximately the same level of enlistments from approximately the same size manpower pool whose members have approximately the same amount of information and persuasion targeted on them and whose members tend to respond to the need in approximately the same way in approximately the same seasonal pattern. Some further simplifying could be achieved through use of rates rather than absolute values, e.g., enlistment needs per thousand in the eligible manpower pool. After all the units have been classified into several homogeneous groups, one unit from each group should be selected at random to test the 3x3 backed up by 6x0, another to test the 4x2 backed up by 6x0, and a third to continue the 6x0 alone. If desired, several units in each group could be used to test each of the options and to continue the 6x0 enlistment.[1]

In the author's opinion, Colonel Young's guidelines are well conceived. Many of the same guidelines were followed in designing the corresponding experiment in the Air Reserve Forces. Basically, the rationale behind designing the experiment in this way is to assure that the units selected to receive the 3x3 and 4x2 options would be representative of all reserve units in terms of the five variables that Colonel Young lists as having a major influence on recruitment productivity. There are sound statistical reasons for proceeding in

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[1] Ibid., pp. 2-3.

this way, even though in theory one can make allowances for imbalances among the groups in these variables by using analysis of covariance or multiple regression. The problem is that, if there are imbalances among the groups on key variables, the analysis becomes much more sensitive to the way that the analytical model is specified, and even if the model is specified perfectly, the efficiencies of the estimates of the parameters are reduced by imbalances among the groups.[1] This amounts to saying that the analysis of the experiment becomes less precise, more sensitive to anomalies in the data, and more vulnerable to the preconceptions and whims of the data analyst.

The variables listed by Colonel Young as having a major influence on the number of enlistments were incorporated into the analysis in the preceding section either directly or indirectly. As a measure of the quantitative need for people, the deficit in enlisted strength at the start of the experiment was used. The size of the eligible manpower pool in each state is approximately proportional to the college age male population. The editing process removed some of the imbalances in recruiting effort across states, and two measures of recruiting effort served as proxies for the "amount of information and persuasion targeted on the members of the eligible manpower pool." The tendency of the members of the eligible manpower pool to enlist is indicated by the preexperimental enlistment rates as well as by certain demographic variables (INC, BLCK, UN, EDUC, and the regional indicator variables).

Perhaps the major flow in the design of the experiment was to offer the shorter enlistment options on such a wide scale and simultaneously give the experiment as much publicity as it received. Recruiters in all states were informed at the start of the experiment that the Army would conduct a 90-day test of the options with approximately one-third of the states offering each of the options. Given this information, many recruiters probably anticipated having a shorter

[1]Gus W. Haggstrom, "The Pitfalls of Manpower Experimentation," in H. Wallace Sinaiko and Laurie A. Broedling (eds.), Perspectives on Attitude Assessment: Surveys and Their Alternatives, Smithsonian Institution, Washington, D.C., 1975.

enlistment option to offer at the end of 90 days. After all, would the Army offer the options on such a wide scale if there were any chance of not reducing the tour of duty for all new reservists? The anticipated flow of mail to Congress when the 6x0 recruits went on active duty for training and learned that most of their buddies from other states had enlisted under 3x3 or 4x2 schemes would surely be sufficient to force the military to undertake a shorter enlistment tour immediately.

Colonel Young's recommendations for carrying out the test were as follows:

> After stratification and selection of units, the test should be administered in such a way that the participants do not realize that the options, in fact, comprise a test for a specified period. If for a specified period, the recruiters in the 3x3 and 4x2 units would introduce immeasurable bias by touting their options as short term bargains that could only be had during the test period. Similarly, it would be important to control information to the "6x0 only" units so that participants in those units do not know about the test. That knowledge would possibly make them think that the system would soon change to give them the options being tested and that by waiting a short period they could get a better deal. Those expectations would introduce immeasurable bias.[1]

Fortunately, the test was later extended from 90 days to six months to eliminate some of the short-term effects that Colonel Young alludes to. However, there is no way of knowing the extent to which the biases inherent in the wide-scale test influenced the experimental results.

Why was the Army experiment designed and conducted the way it was, given that DoD officials were familiar with both the rationale and the experimental design for the corresponding Air Force test? The answer lies partly in DoD's recommendations for carrying out the test.

> It is recommended that the Army test consist of a three-way test with one-third of the force within each

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[1] Colonel Robert S. Young, op. cit., pp. 3-4.

> geographic region of the United States offering each of the term alternatives (three-year, four-year, and six-year) in locations selected for demographic comparability. To insure an acceptable interface between Army and Air Force tests, the three-year option must be offered in Miami, Florida; Fort Worth, Texas; Youngstown, Ohio; and Tacoma, Washington; the four-year option must be offered in Kansas City, Missouri; San Francisco, California; Dover, Delaware; and Charleston, South Carolina. In order to minimize the interference of exogenous factors, the Army should divide its Reserve Components recruiting efforts and advertising budget equally among the three term alternatives. The Naval Reserve and Marine Corps Reserve recruiting efforts during the duration of the Army test should remain unchanged. The test period will be initially set at 90 days with the option that OSD may approve extension or expansion to other components depending on results.[1]

The Army chose to follow the key provisions of these recommendations closely by offering each of the options in approximately one-third of the states. Also, the states mentioned in the recommendations were assigned to the appropriate experimental groups. However, Army officials freely admit that, subject to these provisions, the test was designed insofar as possible to put the states that were "hurting" the most for enlistments into the experimental groups.

Another serious flaw in the execution of the experiment was to permit the recruiting campaigns to confound the experiment. Each of the three groups should have received approximately the same level of recruiting effort, and the amount of recruiting activity in each campaign should have been monitored carefully.[2] By conducting the intensive recruiting campaigns primarily in the 3x3 states, the Guard effectively destroyed the credibility of the experiment insofar as establishing the worth of the shorter enlistment options is concerned.

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[1] Communicated to me by Lt. Col. Eugene C. Gamble, Office of Reserve Components, U.S. Army.

[2] Ideally, the recruiting campaigns should have been incorporated into the experimental design from the outset as an additional treatment variable. By conducting the campaigns in carefully selected states and by monitoring the campaigns to measure the types and levels of recruitment activity, the cost-effectiveness of these campaigns could be assessed in conjunction with the analysis of the shorter enlistment options.

If the analysis had shown a 100 percent increase in NPS enlistments attributable to the 3x3 options, no one would have believed it because of this factor. Presumably, the 3x3 states were chosen for most of the campaigns to take advantage of the shorter options and bring more recruits into the fold. But why was Louisiana, an overstrength state, chosen for a campaign late in the experiment when Louisiana's recruiting had been strong throughout the period?

Efforts should have been taken to guarantee no letdown in recruiting performances in the 6x0 states during the experimental period. In this regard, it is important to have all participants in the experiment operate under the same set of incentives. At the very least, the recruiters should have been informed that all of their performances would be monitored more closely during the experimental period. It is interesting that, when this and other safeguards were taken in the corresponding test in the Air Reserve Forces, the estimates of the responses to the enlistment options were considerably lower.

The analysis of the experiment would have been more informative if the Army had monitored its recruiting activity more closely. Because of the lack of a suitable data system for getting enlistments data on a timely basis, the Office of Reserve Components resorted to asking for flash reports from the individual states at the end of each month. Not only did this institute a new time-consuming report, it probably also led to clerical errors and incorrect counts of recruits. In contrast, the Air Force was able to supply monthly listings on magnetic tape of new NPS recruits into the Air Reserve Forces <u>before</u> the Air Force experiment began. These listings provided the name, social security number, reserve unit, and several personal characteristics of each recruit, thereby facilitating rapid tabulations of numbers of recruits by sex, race, and mental category as well as providing measures of recruiter productivity for each unit.

The effects of the shorter enlistment options in the USAR could not be analyzed as they were in the ARNG because of inadequate data on recruiting performance in the USAR. Since the USAR seems to be having more trouble meeting its recruiting requirements than the ARNG, it would have been informative to carry out a detailed analysis of

USAR recruiting across states and to draw comparisons with the ARNG. However, the USAR could provide no information on the amount of recruiting activity that takes place routinely within each state, and they could not supply state-by-state monthly figures on NPS enlistments for the six months before the experiment began. The ARNG also needs to monitor its recruiting activity more closely. It would have been helpful to have measures of the recruiting effort that went into the highly productive campaigns conducted by the ARNG in several states. It is important to assess the cost-effectiveness of those campaigns in formulating an overall recruitment strategy for the reserves in the future. Also, steps should have been taken to monitor recruiting more closely within states to isolate unusually productive recruiters (or units), determine successful advertising techniques, and assess the cost-effectiveness of various types and levels of recruiting activity.

In summary, the variable tour experiment in the Army Reserve Components was poorly designed, improperly conducted, and inadequately monitored. The lessons learned from this experiment should be considered carefully in devising a better system for monitoring the recruiting process and in setting guidelines for future experimentation of a similar nature.

VII. LESSONS LEARNED

Despite its flaws, the variable tour experiment in the Army Reserve Components yielded valuable information about the recruiting process. It indicated that implementing a shorter enlistment option for all recruits would probably not yield a sufficient number of additional recruits to offset future man-year losses, let alone compensate for the additional costs associated with a shorter enlistment tour. It destroyed the myth that the six-year enlistment was the major reason for the recruiting shortfalls in the reserves. And it showed that other factors (unemployment rates, recruiting effort, demand for new recruits) play a more important role in the recruiting process.

When the experimental results indicated that the proposal to adopt the 3x3 option across the board would probably be detrimental to the reserves, the Department of Defense stopped the experiment on December 31, 1973. A few months later, the Secretary of Defense authorized the reserves to enlist a limited number of men under 3x3 and 4x2 enlistment options, but these options were restricted to not more than 20 percent of the total NPS enlistments and to applicants in the higher mental categories.[1]

As an indication of the savings that DoD achieved by deferring the implementation of the 3x3 scheme for a single year, in 1973 the Army and Air Force reserve components had approximately 25,000 male NPS enlistees of whom approximately 20,000 enlisted for the full six years. If the 3x3 scheme had been enacted across the board at the beginning of the year and if the 3x3 scheme had yielded 30 percent more enlistees, then instead of having 20,000 enlistees with a six-year commitment they would have had 26,000 3x3 enlistees. Based upon current attrition rates in the ARNG, these 20,000 six-year enlistees will average 6.7 years of service in the active reserves for a total of 134,000 man-years, whereas the 26,000 3x3 enlistees would average only 4.6 years of service for a

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[1] "Shorter Hitch OKed in Selected Reserve," Air Force Times, April 17, 1974, p. 21.

total of 120,000 man-years. Thus, in 1973 alone, by experimenting instead of adopting the 3x3 scheme across the board, the Army and Air Force reserve components will have gained 14,000 man-years. This gain will occur despite the fact that the reserves will forego approximately 16,000 man-years during the first three years by giving up the 6,000 additional 3x3 recruits. But the reserves will compensate for this short-term loss of 16,000 man-years between 1973 and 1976 by a gain of approximately 30,000 man-years during the following three years at a time when the reserves will be depleting its present supply of draft-induced volunteers.

The failure of the 3x3 scheme to live up to its expectations will lead the military to consider other recruiting strategies that might have been overlooked had the experiment not taken place. Given the experimental results, the services may want to take another look at the 4x2 scheme, or they may want to consider a variable enlistment bonus that pays long-term enlistees more than the short-termers. By restricting the options to only a small proportion of the recruits, they can also use the option as a special inducement for recruits having special qualifications.

The experimental results showed that the Army National Guard conducted some amazingly productive recruiting campaigns in certain states during the experimental period. Although these campaigns seemed to be most successful in the 3x3 states, they also produced many additional recruits in the 6x0 states. These campaigns clearly deserve closer study in formulating an overall recruiting strategy for the Army Reserve Components. They should be monitored more carefully in the future to assess their cost-effectiveness and to establish what particular aspects of the campaigns play a dominant role in attracting new recruits.

Another implication of the variable tour experiment that should be exploited in formulating future recruitment strategies is that several states (Alabama, Arkansas, Louisiana, and Oklahoma) and Puerto Rico maintained very high enlistment rates during the experiment, despite the fact that they were overstrength and therefore somewhat constrained in their recruiting efforts. These states seem capable of manning larger Army reserve units than they have now. On the other hand, several other states that have high deficits in strength had consistently low enlistment rates, especially in the USAR.

The finding that reserve enlistment rates are sensitive to changes in the unemployment rates may have important implications for the future. Whereas the reserves have managed to maintain their enlisted strength during 1974 and the early part of 1975, if the economy recovers in late 1975 and unemployment rates decline, the reserves may once again have trouble meeting their recruiting requirements.

An important aspect of this experiment, as well as the corresponding experiment in the Air Reserve Forces, is that it sets a precedent for using partially controlled field studies to evaluate recruitment strategies. While there are many lessons to be learned from these experiments in designing and conducting future experiments, perhaps the most important lesson is that, despite the obvious flaws in these experiments, a lot of valuable information about the recruiting process and the attractiveness of incentives can be gained from an experiment of this type. Finally, these experiments show that, by evaluating their recruiting strategies on a trial basis before they are implemented, the services can minimize the negative effects of ill-conceived strategies that seem so promising before they are implemented.

Appendix A

THE EXPERIMENTAL DATA

This appendix contains the state-by-state data that were used in evaluating the variable tour experiment. Tables A-1 and A-2 provide the monthly statistics on NPS accessions for the ARNG and USAR. Table A-3 contains the overall strength characteristics of the states' Army Reserve Components as of the beginning of the experiment as well as measures of the ARNG recruiting effort. Table A-4 provides the values of several demographic variables for each state. The sources of these data are given below.

The accessions data in Tables A-1 and A-2 and the strength figures in Table A-3 were obtained from Lieutenant Colonel Eugene Gamble, Enlistment Management Team, Office of Reserve Components, U.S. Army. During the experimental period, Lt. Col. Gamble obtained monthly "flash reports" on NPS accessions from the reserve components in each state. These reports were instituted, in part, because monthly state-by-state accessions data were not available for the USAR before the experiment began. Also, these reports provided more timely information on the progress of the experiment than would have been possible through other means. Except for the first month of the experiment when there was apparently some underreporting of enlistments on the flash reports, the flash report totals tended to agree closely with the official figures reported later.

The measures of recruiting effort for the ARNG in Table A-3 were obtained from the Manpower Systems Division, Office of the Assistant Secretary, Department of the Army. With the exception of 29 full-time recruiters located in recruiting main stations throughout the United States, recruiter counts in the last column of Table A-3 refer to parttime unit recruiters enlisting both prior and nonprior servicemen. The counts do not include either the recruiting managers and their assistants at the state headquarters or the in-service recruiters located at various military installations whose primary function is to recruit prior servicemen as they are separated from active duty.

The sources of the data in Table A-4 were as follows:

Regional designations (S - South, W - West, NE - Northeast, NC - North Central): U.S. Bureau of the Census, Statistical Abstract of the U.S.: 1974, 95th Edition, Washington, D.C. 1974. (See map inside front cover.)

Male population, age 18-24: Bureau of the Census, Census of Population: 1970, General Population Characteristics, Final Report PC(1)-B2-53, U.S. Government Printing Office, Washington, D.C., 1972, Table 20.

Median earnings of males, 16 years and over with earnings, in the experienced labor force for selected occupation groups: U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C2-53, U.S. Government Printing Office, Washington, D.C., 1971, Table 57.

Unemployment rates: Estimated using the 1973 unemployment rates published by the U.S. Department of Labor in Manpower Report of the President, Washington, D.C. 1974, p. 330 and monthly insured unemployment rates reported in Department of Labor, Employment and Earnings, Washington, D.C.

Percent of population in rural areas: U.S. Bureau of the Census, Census of Population: 1970, Vol. 1, Characteristics of the Population, Government Printing Office, Washington, D.C. 1972, Part 1, United States Summary, Table 18.

Percent of population in active military service: Department of Defense, OASD(Comptroller), Directorate for Information Operations, Selected Manpower Statistics, April 15, 1973, pp. 15-17.

Education index (percentage of high school graduates among males 16 to 21 years old not attending school): U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C2-53, U.S. Government Printing Office, Washington, D.C., 1972, Table 51.

Table A-1

NONPRIOR SERVICE ACCESSIONS DURING 1973
ARMY NATIONAL GUARD

Figures in the table include both male and female accessions. The numbers of female accessions during the last six months of 1973 are given in parentheses.

State	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Alabama	75	72	78	95	74	64	25	49	90(1)	35	29	64(1)	750
Alaska	13	10	19	7	9	20	4(1)	9	9	29	28	17	174
Arizona	18	5	19	25	53	16	9	6	10	11(1)	24(2)	18	214
Arkansas	48	35	29	27	26	55	22(5)	18(1)	22(1)	17	19	33(2)	351
California	117	105	194	162	246	162	167(14)	110(8)	81(3)	86(2)	257(6)	137(15)	1824
Colorado	4	7	3	2	2	5	2(1)	0	9(2)	5(3)	5(2)	7(5)	51
Connecticut	39	38	14	15	19	22	22	37(2)	14(1)	63(2)	36(2)	25(1)	344
Delaware	10	7	10	15	16	33	16(1)	3	10	15(4)	6	12(1)	153
Dist. of Columbia	10	9	10	10	4	12	7	9	9(1)	10	6	8	104
Florida	30	28	38	17	27	21	20	31(2)	38(2)	21(1)	35(5)	75(12)	381
Georgia	25	7	22	39	23	39	5	27	105(2)	38(1)	15	46	391
Hawaii	27	33	22	15	22	15	9(1)	13(1)	11	6	5	5	183
Idaho	24	17	29	9	5	1	9	8	2	4(2)	5(1)	5(1)	118
Illinois	16	16	29	11	20	7	5	11	9(2)	12	89(10)	22(2)	247
Indiana	66	37	33	35	42	200	97(12)	145(18)	51(6)	105(8)	65(5)	53	929
Iowa	15	12	18	10	10	9	4	16	21	5(1)	13(2)	44(6)	177
Kansas	39	23	25	28	29	40	36	45(6)	22(3)	14	33(5)	63(4)	397
Kentucky	25	30	18	15	23	46	17	15(2)	10(1)	17	6(2)	12	234
Louisiana	44	46	43	41	110	206	107(1)	65(2)	75(8)	85(6)	392(45)	102(16)	1316
Maine	8	11	10	7	6	7	3	1	3	1	3	7	67
Maryland	63	66	54	41	54	110	78(5)	45(3)	61	43	154(5)	76(7)	845
Massachusetts	49	49	22	18	34	55	25(1)	50(2)	33	273(10)	89(9)	37	734
Michigan	29	15	20	12	15	25	18(1)	44(4)	57(12)	24(2)	29(1)	26(2)	314
Minnesota	32	25	14	22	65	42	55(2)	29(2)	20(7)	14(3)	43(6)	93(13)	454
Mississippi	39	33	30	43	16	169	25(1)	46	77	31	48	11	568
Missouri	33	17	19	17	13	25	12(1)	29(2)	12(1)	35(2)	27(5)	29(2)	268
Montana	7	3	9	10	3	11	0	6	4(1)	4	5	4	66
Nebraska	12	5	35	23	8	10	4	4	4(1)	6(1)	6(1)	11(1)	128
Nevada	47	6	10	3	21	23	11(2)	13(2)	7(3)	8(3)	12(1)	15(6)	176
New Hampshire	3	3	1	4	2	11	1	15	10	4	6	4	64
New Jersey	43	22	41	35	71	69	65	128	127	341(3)	70(2)	36(2)	1048
New Mexico	31	29	27	20	33	48	11	24	28	35	14	30(3)	330
New York	45	31	23	20	31	26	24	37(3)	18(2)	29(2)	122(6)	127(3)	533
N. Carolina	146	29	27	26	28	63	54(4)	60(2)	44(4)	43(3)	74(6)	152	746
N. Dakota	14	9	6	2	8	2	3	15(3)	8	7(2)	4(1)	9	87
Ohio	29	31	27	16	34	34	5(2)	43(5)	85(9)	32(2)	49(5)	81(3)	466
Oklahoma	59	48	74	103	94	223	9	17	21	27	34	81(1)	790
Oregon	68	56	54	56	28	57	49	75	18(1)	21(2)	39	35	556
Pennsylvania	59	21	22	36	33	61	28	40(1)	34	28	123(3)	100(3)	585
Rhode Island	6	3	9	5	11	3	18(2)	14(1)	13	4(1)	9	32(2)	127
S. Carolina	27	22	21	25	45	75	40	28	33	29	27	26(1)	398
S. Dakota	16	4	9	14	24	37	3	6(1)	4(1)	9(1)	9(1)	32(1)	167
Tennessee	58	53	50	41	51	33	37	36(2)	19	8	18	163(1)	567
Texas	42	39	54	60	73	104	72(3)	121(1)	48(1)	89	71(1)	96(4)	869
Utah	14	10	14	16	13	9	5	7	11	7	20(1)	13(1)	139
Vermont	37	10	11	17	19	24	5	11	14	8	14	14	184
Virginia	9	5	12	8	5	3	12(2)	8	13	51	42(1)	40	208
Washington	66	38	59	42	7	81	82(9)	41(9)	33(1)	29(1)	57(5)	22	557
W. Virginia	35	15	23	16	5	5	13(1)	19	7	9	3	12	162
Wisconsin	24	15	28	24	11	49	8	11	12	5	9	293(7)	489
Wyoming	8	11	5	3	4	2	3	4	4	2	61(14)	11(1)	118
Puerto Rico	17	37	91	131	70	69	45	56	39	44	8	22	629
	1820	1308	1564	1494	1695	2538	1406 (72)	1700 (85)	1519 (77)	1878 (69)	2367 (161)	2488 (130)	21777

Table A-2

NONPRIOR SERVICE ACCESSIONS DURING 1973
UNITED STATES ARMY RESERVE

Figures in the table include both male and female accessions. The numbers of female accessions are given in parentheses, except for July when the data were not available.

State	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Alabama	2	11(7)	12(6)	10(8)	6(6)	1	42
Alaska	0	0	0	0	0	0	0
Arizona	3	3(1)	7(1)	7(1)	1	4	25
Arkansas	3	7(3)	7(2)	4(1)	1(1)	5(2)	27
California	41	50(15)	50(26)	50(27)	59(33)	37(4)	287
Colorado	10	6	5(4)	1	1(1)	1(1)	24
Connecticut	3	4	6	6(2)	5(2)	4(1)	28
Delaware	4	1	0	2	3	3(1)	13
Dist. of Col.	0	1	0	0	0	0	1
Florida	5	15(3)	20(7)	13(8)	8(4)	2(2)	63
Georgia	2	5(1)	5	13(11)	0	0	25
Hawaii	0	0	2	0	2	0	4
Idaho	2	5	24(18)	3(1)	4	2	40
Illinois	18	3	24(14)	4	17(7)	5(3)	71
Indiana	11	4	5	6(1)	8(3)	9(4)	43
Iowa	2	3	0	5(1)	6(6)	3(3)	19
Kansas	3	6(3)	1	7(6)	8(6)	5(4)	30
Kentucky	10	5(2)	8(6)	12(7)	7(3)	1	43
Louisiana	7	39(5)	14(1)	11(1)	18(3)	14(5)	103
Maine	1	1	1	6(4)	2	0	11
Maryland	11	10(2)	17(8)	16(9)	7(4)	1	64
Massachusetts	22	12(2)	0	11(2)	8(4)	11(4)	62
Michigan	19	15	5	6	8(4)	4(1)	57
Minnesota	2	7(4)	3(3)	3	7(5)	9(3)	31
Mississippi	4	6(1)	4(1)	9(1)	3	3	29
Missouri	5	18(6)	9(2)	6(2)	10(7)	8(6)	56
Montana	0	0	9(6)	5(2)	1	1(1)	16
Nebraska	1	1	1	4(3)	4(2)	5(2)	16
Nevada	0	0	0	0	0	0	0
New Hampshire	0	1(1)	0	1	7(3)	0	9
New Jersey	7	9(2)	5(1)	14(10)	1	4	40
New Mexico	6	9(4)	0	4	4(1)	1	24
New York	9	20(9)	14(4)	35(18)	32(12)	22(7)	132
North Carolina	4	6(3)	2	2(1)	3(1)	2	19
North Dakota	0	0	0	1	0	0	1
Ohio	3	20(11)	19(5)	5(2)	15(2)	4(2)	66
Oklahoma	6	9(2)	5(2)	0	4(1)	2	26
Oregon	5	5(4)	1	4(4)	12(9)	0	27
Pennsylvania	41	25(3)	30(4)	39(16)	30(3)	25(5)	190
Rhode Island	2	1	0	2	2(1)	1	8
South Carolina	6	0	5(2)	0	0	0	11
South Dakota	0	1	0	0	0	0	1
Tennessee	2	4(2)	7(5)	3(3)	8(7)	2	26
Texas	4	34(4)	24(6)	16(3)	20	4	102
Utah	3	3	17(10)	2(1)	11(4)	7(1)	43
Vermont	0	0	0	1	2	0	3
Virginia	4	16(7)	2(2)	2	6(5)	9(4)	39
Washington	14	25(13)	16(4)	12(6)	16(11)	18(9)	101
West Virginia	8	9(1)	4	11(2)	5	3(1)	40
Wisconsin	16	16(5)	9(1)	6(3)	16(12)	13(2)	76
Wyoming	0	0	0	0	0	0	0
Puerto Rico	18	32(12)	12(1)	6(2)	15	10(3)	93
	349	483 (138)	411 (152)	386 (169)	413 (173)	265 (81)	2307

Table A-3

STRENGTH AND RECRUITING EFFORT STATISTICS
ARMY RESERVE COMPONENTS

State	Experi-mental Group	Enlisted Strength as of June 30, 1973: Actual ARNG	Actual USAR	Actual Total	Authorized ARNG	Authorized USAR	Authorized Total	Deficit ARNG	Deficit USAR	Deficit Total	Recruiting Effort (ARNG Only): Direct Recruiting Obligations	No. of Recruiters
Alabama	6x0	15115	4117	19232	14538	4644	19182	-577	527	-50	$ 357,330	359
Alaska	6x0	1790	87	1877	2090	208	2298	300	121	421	62,845	58
Arizona	4x2	2648	1233	3881	2706	1083	3789	58	-150	-92	66,336	70
Arkansas	6x0	7727	1867	9594	7460	1974	9434	-267	107	-160	115,417	175
California	4x2	17755	11660	29415	20468	12925	33393	2713	1265	3978	286,267	358
Colorado	6x0	2460	1584	4044	2897	1854	4751	437	270	707	52,011	72
Connecticut	3x3	4428	3034	7462	5529	3998	9527	1101	964	2065	108,334	109
Delaware	4x2	2159	626	2785	2452	1048	3500	293	422	715	48,382	38
Dist. of Col.	4x2	1631	712	2343	2074	1246	3320	443	534	977	30,337	32
Florida	3x3	7233	5475	12708	7622	5677	13299	389	202	591	102,120	163
Georgia	6x0	8423	4639	13062	8396	3971	12367	-27	-668	-695	100,600	180
Hawaii	3x3	2896	1110	4006	3332	1878	5210	436	768	1204	51,645	75
Idaho	6x0	3082	674	3756	3211	885	4096	129	211	340	74,129	80
Illinois	6x0	10568	10352	20920	10609	10330	20939	41	-22	19	96,392	188
Indiana	6x0	9094	5303	14397	9585	6534	16119	491	1231	1722	133,943	177
Iowa	6x0	7107	2808	9915	7259	4187	11446	152	1379	1531	111,255	167
Kansas	4x2	6116	2733	8849	6903	3437	10340	787	704	1491	104,649	170
Kentucky	6x0	4639	4999	9638	4761	5337	10098	122	338	460	96,639	103
Louisiana	3x3	7477	2859	10336	7444	2947	10391	-33	88	55	254,285	147
Maine	6x0	2660	838	3498	2650	908	3558	-10	70	60	56,602	63
Maryland	4x2	5431	5177	10608	6213	6056	12269	782	879	1661	71,605	132
Massachusetts	3x3	11625	6008	17633	13777	9103	22880	2152	3095	5247	215,918	252
Michigan	6x0	8664	5710	14374	9497	6226	15723	833	516	1349	152,583	197
Minnesota	6x0	7937	5142	13079	9181	6650	15831	1244	1508	2752	110,366	178
Mississippi	3x3	9354	2189	11543	9423	2252	11675	69	63	132	141,699	238
Missouri	4x2	7809	4397	12206	8229	4378	12607	420	-19	401	163,798	173
Montana	6x0	2193	822	3015	2253	1075	3328	60	253	313	30,807	60
Nebraska	4x2	3465	1619	5084	4063	1995	6058	598	376	974	93,884	79
Nevada	4x2	1080	169	1249	1276	206	1482	196	37	233	40,987	30
New Hampshire	6x0	1872	792	2664	2088	942	3030	216	150	366	54,003	57
New Jersey	3x3	12132	5745	17877	13123	7704	20827	991	1959	2950	294,277	230
New Mexico	3x3	3140	615	3755	3054	674	3728	-86	59	-27	62,737	77
New York	6x0	20224	17855	38079	22310	19214	41524	2086	1359	3445	166,227	397
North Carolina	4x2	9411	5032	14443	9929	4675	14604	518	-357	161	134,180	241
North Dakota	4x2	2091	403	2494	2260	614	2874	169	211	380	48,533	66
Ohio	3x3	12654	9040	21694	14094	8614	22708	1440	-426	1014	168,850	286
Oklahoma	6x0	8281	3157	11438	8041	3671	11712	-240	514	274	130,225	170
Oregon	3x3	5249	1427	6676	5893	560	6453	644	-867	-223	93,873	119
Pennsylvania	3x3	14649	14971	29620	16672	18824	35496	2023	3853	5876	305,252	331
Rhode Island	3x3	2519	1198	3717	2936	1416	4352	417	218	635	79,805	60
South Carolina	4x2	8409	3207	11616	9260	2951	12211	851	-256	595	205,640	192
South Dakota	6x0	3101	176	3277	3304	186	3490	203	10	213	64,349	112
Tennessee	6x0	9471	3139	12610	9970	3301	13271	499	162	661	108,757	208
Texas	3x3	14089	8433	22522	15853	7525	23378	1764	-908	856	402,095	349
Utah	6x0	4201	2413	6614	4271	3214	7485	70	801	871	90,302	90
Vermont	6x0	2548	348	2896	2600	450	3050	52	102	154	62,567	64
Virginia	4x2	6996	5273	12269	7319	4445	11764	323	-828	-505	173,991	168
Washington	3x3	4653	2876	7529	5755	5049	10804	1102	2173	3275	134,184	107
West Virginia	3x3	2766	1864	4630	3031	2028	5059	265	164	429	87,838	80
Wisconsin	3x3	8115	5922	14037	9218	7697	16915	1103	1775	2878	161,986	186
Wyoming	6x0	1258	116	1374	1495	161	1656	237	45	282	35,414	52
Puerto Rico	6x0	6675	1504	8179	6363	1371	7734	-312	-133	-445	46,032	104
Total		347070	193449	540519	374737	218298	593035	27667	24849	52516	$6,442,282	7869

Table A-4

DEMOGRAPHIC CHARACTERISTICS OF THE STATES

		Male Population of Age 18-24			% Unemployed, 1973		% of Population in		
State	Region	Total	% Black	Median Earnings	Jan.- June	Jul.- Dec.	Urban Areas	Military Service	Education Index
Alabama	S	195,380	24.7	$5,999	4.4	3.9	58.4	0.65	47.1
Alaska	W	45,517	10.2	10,881	11.8	9.0	48.4	8.11	72.1
Arizona	W	105,012	10.1	7,417	3.7	3.4	79.6	1.46	58.5
Arkansas	S	101,868	17.3	5,264	4.7	3.6	50.0	0.48	49.4
California	W	1,236,045	11.5	8,520	5.7	4.6	90.9	1.11	65.8
Colorado	W	148,296	5.8	7,495	3.4	2.8	78.5	1.98	66.3
Connecticut	NE	155,783	7.0	8,678	5.8	5.3	77.4	0.15	59.1
Delaware	S	30,171	14.6	7,970	4.4	4.4	72.2	1.06	62.3
Dist. of Col.	S	48,552	65.9	6,711	2.9	3.0	100.0	2.52	49.5
Florida	S	354,160	16.4	6,625	2.0	2.1	80.5	0.95	56.2
Georgia	S	293,813	24.5	6,208	3.9	3.7	60.3	1.11	49.0
Hawaii	W	61,492	3.3	8,055	5.6	5.6	83.1	4.59	74.4
Idaho	W	39,585	2.8	6,787	5.6	4.8	54.1	0.72	66.4
Illinois	NC	586,161	13.3	8,518	4.1	3.3	83.0	0.34	59.2
Indiana	NC	290,392	7.2	7,899	3.9	3.5	64.9	0.14	56.9
Iowa	NC	147,259	2.0	7,289	3.3	2.4	57.2	0.02	70.3
Kansas	NC	139,913	7.2	7,000	3.5	2.8	66.1	1.41	66.8
Kentucky	S	199,124	8.1	6,369	4.9	3.7	52.3	1.05	48.7
Louisiana	S	221,060	28.0	6,536	6.4	5.3	66.1	0.72	49.8
Maine	NE	54,522	1.4	6,333	7.2	5.2	50.8	0.59	60.6
Maryland	S	222,760	18.3	8,177	4.4	3.7	76.6	1.26	57.4
Massachusetts	NE	315,760	3.4	7,927	7.2	6.4	84.6	0.32	62.0
Michigan	NC	488,895	12.5	8,772	7.3	6.4	73.8	0.15	57.1
Minnesota	NC	200,697	1.2	7,730	5.4	4.0	66.4	0.08	74.1
Mississippi	S	130,093	33.3	5,042	4.3	3.6	44.5	0.89	45.5
Missouri	NC	252,306	10.0	7,277	4.5	3.6	70.1	0.57	60.1
Montana	W	38,002	5.2	6,930	7.4	5.4	50.4	0.81	68.1
Nebraska	NC	82,499	4.1	6,628	3.6	2.7	61.5	0.79	71.5
Nevada	W	26,126	6.4	8,308	6.3	5.3	80.9	1.78	70.7
New Hampshire	NE	42,432	1.4	7,247	4.1	3.7	56.4	0.69	57.9
New Jersey	NE	352,347	11.6	8,624	7.3	6.3	88.9	0.55	61.4
New Mexico	W	59,237	2.5	6,685	6.2	5.4	69.8	1.52	63.2
New York	NE	923,324	11.9	8,197	5.3	4.7	85.6	0.13	56.0
North Carolina	S	350,656	21.1	5,627	2.8	2.2	45.0	1.66	50.1
North Dakota	NC	37,794	1.2	6,173	5.7	3.9	44.3	1.98	72.3
Ohio	NC	569,731	8.9	8,284	3.8	3.1	75.3	0.14	61.3
Oklahoma	S	151,737	7.0	6,500	4.5	3.8	68.0	0.93	61.5
Oregon	W	116,196	1.8	7,731	5.5	4.8	67.1	0.07	66.3
Pennsylvania	NE	591,684	8.6	7,567	4.8	3.9	71.5	0.09	63.9
Rhode Island	NE	68,150	3.6	7,184	6.3	6.0	87.1	0.89	60.5
South Carolina	S	185,922	27.1	5,658	3.8	3.5	47.6	2.08	51.6
South Dakota	NC	37,386	0.9	5,811	3.8	2.7	44.6	0.88	67.8
Tennessee	S	229,641	15.0	5,907	3.4	2.6	58.8	0.29	48.8
Texas	S	687,490	12.1	6,824	3.2	2.9	79.7	1.31	53.2
Utah	W	67,402	1.5	7,454	6.1	4.8	80.4	0.42	65.8
Vermont	NE	30,852	0.4	6,789	6.2	4.5	32.2	0.04	60.0
Virginia	S	321,366	16.2	6,865	2.7	2.4	63.1	1.47	56.1
Washington	W	214,170	3.2	8,450	8.2	6.9	72.6	0.98	68.6
West Virginia	S	92,525	3.5	6,955	6.7	5.2	39.0	2.52	49.3
Wisconsin	NC	240,304	3.3	7,868	5.1	3.8	65.9	0.02	69.3
Wyoming	W	18,417	1.7	7,335	4.0	2.8	60.5	1.05	67.8
Puerto Rico	S	159,717	15.0	2,827	11.2	13.3	58.1	0.22	25.4

Appendix B

THE RECRUITING CAMPAIGNS

This appendix provides an analysis of the effects of the intensive recruiting campaigns that were conducted in many states by the Army National Guard. As Table 4 in Section III showed, these campaigns were extremely productive, and allowances for their effects had to be made in analyzing the variable tour experiment since more of these campaigns were conducted in the 3x3 states than in the control group.

The technique used to remove the effects of the recruiting campaigns was to replace the total number of male NPS recruits in each state during the six-month experimental period by the "Winsorized" total that resulted when the largest and smallest monthly totals were replaced by the next largest and next smallest. For example, Alabama had 290 male NPS enlistees during the experimental period; its monthly totals from July to December were 25, 49, 89, 35, 29, and 63. Replacing the largest and smallest monthly totals, 89 and 25, by the next largest and next smallest, 63 and 29, reduced Alabama's total to 268. The rationale for using this technique was discussed in Section III.

Table B-1 lists the unedited and Winsorized totals for each state. The table also provides a second set of edited totals, namely, the "trimmed" totals that result from replacing the largest and smallest monthly observations for each state by the mean of the other four. Since the differences between the two sets of edited totals are small and the correlation coefficient across states is $r = 0.999$, either set could have been used in the analysis without appreciably affecting the results.

In attempting to assess the effects of the recruiting campaigns themselves, we were first faced with the problem of identifying the states that had conducted them. During the course of the experiment we were informed by Army officials that special campaigns had been conducted in certain states during the preceding month, and the jump in the number of enlistments that resulted from these campaigns was readily discernible from the monthly recruiting performances. However, it

Table B-1

ANALYSIS OF RECRUITING CAMPAIGN EFFECTS
ARMY NATIONAL GUARD
JULY-DECEMBER 1973

State	Male NPS Recruits, Jul.-Dec. Total	Edited Totals Winsorized	Edited Totals Trimmed	Best Month's Recruiting Performance Month	No. of Recruits	Winsorized Mean	Campaign Effect	P-value
Alabama	290	268	264	Sep.	89	45	44	< .0001
Alaska	95	100	94	Oct.	29	17	--	.004
Arizona	75	74	70	Nov.	22	12	--	.03
Arkansas	122	112	111	Dec.	31	19	--	.05
California	790	698	692	Nov.	251	116	135	< .0001
Colorado	15	12	12	Sep.	7	2	--	.04
Connecticut	189	172	172	Oct.	61	29	32	< .0001
Delaware	56	55	57	Jul.	15	9	--	> .21
Dist. of Col.	48	48	48	Oct.	10	8	--	> .85
Florida	198	171	172	Dec.	63	28	35	< .0001
Georgia	233	186	188	Sep.	103	31	72	< .0001
Hawaii	47	46	45	Aug.	12	8	--	> .40
Idaho	29	28	27	Jul.	9	5	--	> .22
Illinois	134	77	75	Nov.	79	13	66	< .0001
Indiana	467	445	442	Aug.	127	74	53	< .0001
Iowa	94	77	78	Dec.	38	13	25	< .0001
Kansas	195	180	183	Dec.	59	30	29	< .0001
Kentucky	72	77	76	Oct.	17	13	--	> .40
Louisiana	748	511	507	Nov.	347	85	262	< .0001
Maine	18	14	15	Dec.	7	2	--	.12
Maryland	437	362	369	Nov.	149	60	89	< .0001
Massachusetts	485	311	297	Oct.	263	52	211	< .0001
Michigan	176	176	171	Sep.	45	29	--	.011
Minnesota	221	196	195	Dec.	80	33	47	< .0001
Mississippi	237	221	224	Sep.	77	37	40	< .0001
Missouri	131	125	130	Oct.	33	21	--	.05
Montana	22	24	24	Aug.	6	4	--	> .61
Nebraska	31	27	27	Dec.	10	4	--	.14
Nevada	49	50	51	Nov.	11	8	--	> .70
New Hampshire	40	38	36	Aug.	15	6	--	.008
New Jersey	760	581	582	Oct.	338	97	241	< .0001
New Mexico	139	135	140	Oct.	35	22	--	.04
New York	341	341	302	Dec.	124	57	67	< .0001
North Carolina	408	324	324	Dec.	152	54	98	< .0001
North Dakota	40	37	38	Aug.	12	6	--	.15
Ohio	269	294	282	Dec.	78	49	29	< .0001
Oklahoma	188	150	148	Dec.	80	25	55	< .0001
Oregon	234	210	213	Aug.	75	35	40	< .0001
Pennsylvania	346	323	297	Nov.	120	54	66	< .0001
Rhode Island	84	76	76	Dec.	30	13	17	.0001
South Carolina	182	177	176	Jul.	40	30	--	> .21
South Dakota	58	35	36	Dec.	31	6	25	< .0001
Tennessee	278	163	162	Dec.	162	27	135	< .0001
Texas	487	481	480	Aug.	120	80	40	< .0001
Utah	61	56	56	Nov.	19	9	--	.02
Vermont	66	69	70	Sep.	14	12	--	> .74
Virginia	163	155	156	Oct.	51	26	25	< .0001
Washington	239	224	216	Jul.	73	37	36	< .0001
West Virginia	62	59	60	Aug.	19	10	--	.03
Wisconsin	331	60	60	Dec.	286	10	276	< .0001
Wyoming	70	34	32	Nov.	47	6	41	< .0001
Puerto Rico	214	217	225	Dec.	56	36	--	.002

became clear as the experiment progressed that many other states had sizable jumps in recruiting during a single month. Since the Army officials who monitored recruiting activity in the Office of Reserve Components could not identify all the states that had unusual recruiting activity at any point in time, we decided to use purely statistical procedures for identifying the states that had special campaigns. A formal statistical test for detecting outliers in a sequence of Poisson-distributed random variables was devised for identifying the states that had an unusually large number of recruits during a single month. The rationale behind this test is given in the technical note at the end of this appendix.

The test is based on the assumption that, if recruiting activity had been relatively constant in a particular state over the six-month period, the monthly recruiting totals for that state would have approximately the same Poisson distribution.[1] The test identifies the state's best month's recruiting performance as an outlier if the number of recruits was unusually large, given the six-month total for that state. The P-values (significance probabilities) for these tests are given in the last column of Table B-1. For example, Alabama had 89 male NPS recruits in September and a total of 290 over the six-month period--an average of 48 per month. If the monthly recruiting totals were independent, homogeneous, Poisson-distributed random variables, the probability that one of the monthly totals would be as large as 89, given that the six-month total is 290, is less than 0.0001.[2]

Using the somewhat conservative rule of identifying outliers only if the P-value of the test is less than 0.001, 29 states were identified as having an unusually large number of recruits during a single month. The estimates of the campaign effects for these 29 states are given in

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[1]This assumption ignores seasonal factors that surely affect recruiting performances in certain states. However, the aggregate enlistment rates for the Army Reserve Components showed little month-to-month variability after the data had been edited to eliminate the effects of the recruiting campaigns. See Table 6 in Section III.

[2]In fact, it is approximately 0.000001. The method for computing the P-values is given in the technical note at the end of this appendix.

Table B-1. They are computed by taking the difference between the best month's recruiting total and the Winsorized mean of the six monthly totals.[1]

According to these estimates four of the campaigns netted over 200 additional recruits: Wisconsin (276), Louisiana (262), New Jersey (241), and Massachusetts (211). All four offered the 3x3 option.

Table B-2 shows the extent to which the experimental and control groups benefited from the recruiting campaigns according to the estimates in Table B-1. Note that 13 of 16 of the 3x3 states were identified as having an unusually large number of recruits during a single month, whereas only 5 of 13 4x2 states and 11 of 23 6x0 states were so identified.

Table B-2

RECRUITING CAMPAIGN EFFECTS BY EXPERIMENTAL GROUP
ARMY NATIONAL GUARD

Experimental group	No. of States	States with Campaigns	Total Campaign Effects
3x3	16	13	1325
4x2	13	5	376
6x0	23	11	630
All	52	29	2331

The estimates of the total campaign effects in Table B-2 indicate that the recruiting campaigns accounted for approximately 2300 additional male NPS recruits in the Army National Guard during the last half of 1973. Unfortunately there is no data on the amount of recruiting activity that went into these campaigns. Therefore, the cost-effectiveness of this recruiting technique relative to other methods cannot be ascertained. Although it appears that the campaigns were more productive in the 3x3 states than in the other states, it seems likely that the Guard put more effort into the recruiting campaigns in the 3x3 states.

[1]For a discussion of the estimation problem involved here, see the technical note at the end of the appendix.

TECHNICAL NOTE ON TESTING FOR OUTLIERS IN A POISSON PROCESS

This note treats the problem of testing for outliers among independent Poisson-distributed random variables $X_1, X_2, \ldots, X_n$ having unknown means $\lambda_1, \lambda_2, \ldots, \lambda_n$. It is assumed that, with perhaps a single exception, the observations X_i have the same mean $\lambda_i = \lambda$. The problem is to decide whether one of the observations has a larger mean than the others and, if so, which one and by how much.

This can be treated as a multiple decision problem with $n + 1$ hypotheses $H_0, H_1, \ldots, H_n$. Under H_0: $\lambda_i = \lambda$ for $i = 1, 2, \ldots, n$. Under H_j for $j \neq 0$ all the observations have the same Poisson(λ) distribution except X_j, which has a Poisson($\lambda + \mu$) distribution with $\mu > 0$.

A test of these hypotheses can be represented by a vector $\varphi = (\varphi_0, \varphi_1, \ldots, \varphi_n)$ where $\varphi_i(X)$ is the probability of rejecting H_i if $X = (X_1, X_2, \ldots, X_n)$ is observed. Since one of the hypotheses must be accepted, φ must satisfy the condition that $\Sigma_{i=0}^{n} [1 - \varphi_i(X)] = 1$. We shall restrict our attention to tests φ which satisfy the following further restrictions.

(a) φ is of size α $(0 < \alpha < 1)$ for testing H_0, i.e.,

$$E(\varphi_0(X)|H_0) = P(\text{Reject } H_0|H_0) \leq \alpha \qquad \text{for all values of } \lambda;$$

(b) φ has power not less than α under the alternative hypotheses $H_1, H_2, \ldots, H_n$:

$$E(1 - \varphi_i(X)|H_i) = P(\text{Accept } H_i|H_i) \geq \alpha$$

for all values of λ and $\mu > 0$;

(c) φ is invariant over the alternative hypotheses $H_1, H_2, \ldots, H_n$ in the sense that if π is any permutation of the subscripts $(1, 2, \ldots, n) \to (\pi 1, \pi 2, \ldots, \pi n)$, then

$$\varphi_{\pi i}(X_{\pi 1}, X_{\pi 2}, \ldots, X_{\pi n}) = \varphi_i(X_1, X_2, \ldots, X_n).$$

This implies that if φ accepts H_i when $(X_1, X_2, \ldots, X_n)$ is observed, then φ accepts $H_{\pi i}$ when $(X_{\pi 1}, X_{\pi 2}, \ldots, X_{\pi n})$ is observed.

Since $X_1, X_2, \ldots, X_n$ have a joint distribution that belongs to the exponential family, the power function of any test φ is a continuous function of the parameters $\lambda_1, \lambda_2, \ldots, \lambda_n$.[1] It follows that, for tests φ satisfying (a) and (b) above, $P(\text{Reject } H_0 | H_0) = \alpha$ for all values of λ. Tests having this property are said to be similar with respect to H_0. Since $T = \Sigma X_i$ is a complete, sufficient statistic for λ under H_0, it follows that any similar test φ has Neyman structure with respect to T.[2] This means that the similar tests φ can be treated as conditional tests having the same size α for each value of T.

Tests that satisfy the invariance condition (c) clearly have the same power under each of the alternatives in the sense that

$$P(\text{Accept } H_i | \lambda_i = \lambda + \mu) = P(\text{Accept } H_j | \lambda_j = \lambda + \mu)$$

for all $i \neq 0$, $j \neq 0$ and for all λ and $\mu > 0$. Moreover, since the invariance condition must also hold on subsets of the sample space for which T is constant, each invariant test will remain invariant when viewed as a conditional test given T and will have the same conditional power under each of the alternative hypotheses.

It is well known that, if $X_1, X_2, \ldots, X_n$ are independent with $X_i \sim \text{Poisson}(\lambda_i)$, then the conditional distribution of $X = (X_1, X_2, \ldots, X_n)$ given $T = t$ is multinomial:

$$p(x|t) = \frac{t!}{x_1! x_2! \ldots x_n!} p_1^{x_1} p_2^{x_2} \ldots p_n^{x_n}$$

where $p_j = \lambda_j / \Sigma \lambda_i$. Thus, given $T = t$, the problem reduces to finding

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[1] E. L. Lehmann, Testing Statistical Hypotheses, John Wiley & Sons, New York, pp. 52-53.

[2] Ibid., p. 134.

a best invariant test of size α of the hypothesis H_0: $p_1 = p_2 = \ldots = p_n = 1/n$ versus the hypotheses H_i: $p_i = (\lambda + \mu)/(n\lambda + \mu)$, $p_j = \lambda/(n\lambda + \mu)$ for $j \neq i$.

Let $p_i(x|t)$ denote the conditional probability function of X under H_i for given values of λ and $\mu > 0$. The test of size α which maximizes the common value of the conditional probabilities $P(\text{Accept } H_i | H_i, T = t)$ rejects H_0 for large values of V where

$$V = \max_i \, [p_i(X|t)/p_0(X|t)]$$

and accepts H_j if $p_j(X|t) > p_i(X|t)$ for $i \neq j$.[1] In this case,

$$\frac{p_i(X|t)}{p_0(X|t)} = \left(\frac{n\lambda}{n\lambda + \mu}\right)^t \left(\frac{\lambda + \mu}{\mu}\right)^{X_i}$$

so that rejecting H_0 for large values of V is tantamount to rejecting for large values of $X_{(n)} = \max X_i$. Thus, the best invariant test φ^* satisfies

$$\varphi_0^*(X|t) = \begin{cases} 1 & \text{if} \quad X_{(n)} > c(t) \\ \gamma(t) & \text{if} \quad X_{(n)} = c(t) \\ 0 & \text{if} \quad X_{(n)} < c(t) \end{cases}$$

where $c(t)$ and $\gamma(t)$ are chosen so that $\varphi_0^*(X|t)$ has size α under H_0. Since this test does not depend on the values of λ and μ, it is uniformly most powerful among the invariant tests.

The test of H_0 can be conducted for a particular sample by first observing the values of $X_{(n)}$ and T, say m and t, and then computing the P-value $P(X_{(n)} \geq m | T = t)$ under H_0. If the P-value is less than α and X_j is the largest component of X, H_0 is rejected in favor of H_j.

Computing the P-value involves computing a probability of the

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[1] Thomas S. Ferguson, Mathematical Statistics: A Decision Theoretic Approach, Academic Press, New York, 1967, pp. 300-301.

form $P(\max W_i \geq m)$ where $W_1, W_2, \ldots, W_n$ have a multinomial distribution with parameters t and $p_i = 1/n$ for $i = 1, 2, \ldots, n$. If $n = 2$ and $m > t/2$,

$$P(\max W_i \geq m) = P(W_1 \geq m \text{ or } W_2 \geq m) = 2P(W_1 \geq m).$$

Since W_1 has a binomial distribution with parameters t and $p = 1/2$, there is no difficulty computing the P-value in this case. (See below.) For $k > 2$ and relatively large values of t, the calculation of the probabilities $P(\max W_i \geq m)$ becomes difficult. However, Mallows[1] has provided easily computed bounds on these probabilities that suffice for most purposes, namely,

$$1 - (1 - Q)^n \leq P(\max W_i \leq m) \leq nQ$$

where $Q = P(W_1 \geq m) = \Sigma_{k=m}^{t} \binom{t}{k} p^k (1 - p)^{t-k}$, $p = 1/n$. The binomial probability Q can be computed directly from the formula, taken from tables of cumulative binomial probabilities,[2] or calculated from values of the incomplete beta function:[3]

$$Q = B_p(m, t - m + 1)/B_1(m, t - m + 1)$$

where

$$B_p(m, k) = \int_0^p x^{m-1}(1 - x)^{k-1}\, dx.$$

For example, if $n = 6$, $t = 18$, and $m = 7$, then

$$Q = P(W_1 \geq 7) = .0206,$$

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[1] C. L. Mallows, "An Inequality Involving Multinomial Probabilities," Econometrika, 1968, pp. 422-424.

[2] Tables of the Cumulative Binomial Probability Distribution, Harvard University Press, Cambridge, 1955.

[3] Ibid., p. xvii.

and Mallows' bounds are given by

$$.118 \leq P(\max W_i \geq 7) \leq .124.$$

Thus, if $\alpha \leq .05$, H_0 would be accepted. As this example illustrates, Mallows' bounds often pinpoint the P-values with great precision. Moreover, the bounds are even more precise when the P-values are smaller. Since the lower bound satisfies

$$1 - (1 - Q)^n > nQ - \binom{n}{2}Q^2 > nQ - (nQ)^2/2,$$

it follows that Mallows' bounds differ by less than $(nQ)^2/2$. Hence, for small values of the upper bound nQ,

$$P(\max W_i \geq m) \cong nQ.$$

This approximation formula holds with equality if $m > t/2$.

Next, we consider the problem of estimating the parameter values λ and μ under the assumption that at most one of the x_i's may have a larger mean than the others. We begin with a derivation of the maximum likelihood estimators. Since the likelihood function of the sample is

$$L = \prod_{i=1}^{n} e^{-\lambda_i} \lambda_i^{x_i}/x_i!,$$

its logarithm can be written in the form

$$\begin{aligned}\log L &= -\Sigma\, \lambda_i + \Sigma\, x_i \log \lambda_i - \Sigma \log x_i! \\ &= -n\lambda - \mu + \Sigma\, x_i \log \gamma_i + t \log \lambda - \Sigma \log x_i!\end{aligned}$$

where $t = \Sigma\, x_i$ and

$$\gamma_i = \begin{cases} (\lambda + \mu)/\lambda & \text{if} \quad \lambda_i = \lambda + \mu \\ 1 & \text{if} \quad \lambda_i = \lambda \end{cases} .$$

Noting that $\log \gamma_i = 0$ for all but one index i, we see that the term $\Sigma x_i \log \gamma_i$ is maximized by identifying the observation having the largest mean $\lambda + \mu$ to be x_j if $x_j = x_{(n)} = \max x_i$. Making this substitution and rewriting the equation for log L gives:

$$\log L = -n\lambda - \mu + x_{(n)} \log (\lambda + \mu) + (t - x_{(n)}) \log \lambda - \Sigma \log x_i!$$

It follows readily by setting the partial derivatives of log L equal to zero that log L is maximized by

$$\hat{\lambda} = (t - x_{(n)})/(n - 1)$$

$$\hat{\mu} = x_{(n)} - \hat{\lambda}.$$

Thus, the MLE of λ is the average of the observations that remain after deleting the observation having the largest value.

The sampling distributions of these estimators have not been investigated thoroughly, but it is easily seen that these estimators are biased. In data-screening applications like the one considered in this appendix, the following two-stage procedure is recommended in lieu of the MLE:

(1) First test the hypothesis H_0: $\lambda_1 = \lambda_2 = \ldots = \lambda_n = \lambda$ at level α using the test prescribed above. If H_0 is accepted, use the sample mean $\bar{x}$ to estimate λ and estimate μ to be zero.

(2) If H_0 is rejected, estimate λ using a trimmed or Winsorized mean $\tilde{\lambda}$ in lieu of the MLE, and estimate μ using $\tilde{\mu} = x_{(n)} - \tilde{\lambda}$. These estimators have less bias than the maximum likelihood estimators, and they afford protection against outliers in either direction.

In data screening applications where the test for outliers is applied again and again to many sets of observations, one should keep in mind the fact that, even if H_0 holds in every set, testing at level α will identify outliers in approximately 100α percent of the cases tested. To cut the probability of misidentifying outliers in the event that there are none, one may want to prescribe considerably lower values of α than are ordinarily used. Suppose that there are k sets of observations to be screened and that the test for outliers within each set is conducted at level α. Then, if H_0 holds in each of the k sets, the probability β of rejecting H_0 in at least one of the k sets is $\beta = 1 - (1 - \alpha)^k$. For example, if $\alpha = .05$ and $k = 50$, then $\beta = .92$.

One may want to choose α to keep β relatively small, say $\beta = .05$. For any given value of β, the corresponding value of α is $\alpha = 1 - (1 - \beta)^{1/k}$, which is slightly more than β/k for small values of β and $k > 1$. Thus, if $\beta = .05$ and $k = 50$, then $\alpha = .0012$. This choice of α affords high protection against identifying outliers when there are none and tends to accept H_0 when the parameter μ is small relative to λ.

Appendix C

ADDITIONAL TABLES OF RECRUITING PERFORMANCE BY STATE

Tables C-1 and C-2 show the revisions of Tables 14 and 15 of Section V that result when the raw data on ARNG nonprior service accessions are used instead of the edited data.

Table C-1

REVISION OF TABLE 13 USING UNEDITED DATA ON MALE NONPRIOR SERVICE ENLISTMENTS
ARMY NATIONAL GUARD

State	Number of male NPS enlistments (and enlistment rate) Jan-June	July-Dec	% increase	Unemployment rate Jan-June	July-Dec
	6x0 Group				
More than 10% understrength					
Wyoming (15.9)	33 (22.1)	70 (46.8)	112.1	4.0	2.8
Colorado (15.1)	23 (7.9)	15 (5.2)	-34.8	3.4	2.8
Alaska (14.4)	78 (37.3)	95 (45.5)	21.8	11.8	9.0
Minnesota (13.5)	200 (21.8)	221 (24.1)	10.5	5.4	4.0
New Hampshire (10.3)	24 (11.5)	40 (19.2)	66.7	4.1	3.7
	358 (20.2)	441 (24.8)	23.2	5.2	4.0
Less than 10% understrength					
New York (9.4)	176 (7.9)	341 (15.3)	93.8	5.3	4.7
Michigan (8.8)	116 (12.2)	176 (18.5)	51.7	7.3	6.4
South Dakota (6.1)	104 (31.5)	58 (17.6)	-44.2	3.8	2.7
Indiana (5.1)	413 (43.1)	467 (48.7)	13.1	3.9	3.5
Tennessee (5.0)	286 (28.7)	278 (27.9)	- 2.8	3.4	2.6
Idaho (4.0)	85 (26.5)	29 (9.0)	-65.9	5.6	4.8
Montana (2.7)	43 (19.1)	22 (9.8)	-48.8	7.4	5.4
Kentucky (2.6)	157 (33.0)	72 (15.1)	-54.1	4.9	3.7
Iowa (2.1)	74 (10.2)	94 (12.9)	27.0	3.3	2.4
Vermont	118 (45.4)	66 (25.4)	-44.1	6.2	4.5
Utah (1.6)	76 (17.8)	61 (14.3)	-19.7	6.1	4.8
Illinois (0.4)	99 (9.3)	134 (12.6)	35.4	4.1	3.3
	1747 (19.5)	1798 (20.1)	2.9	5.0	4.2
Overstrength					
Georgia (+0.3)	155 (18.5)	233 (27.8)	50.3	3.9	3.7
Maine (+0.4)	49 (18.5)	18 (6.8)	-63.3	7.2	5.2
Oklahoma (+3.0)	601 (74.7)	188 (23.4)	-68.7	4.5	3.8
Arkansas (+3.6)	220 (29.5)	122 (16.4)	-44.5	4.7	3.6
Alabama (+4.0)	458 (31.5)	290 (19.9)	-36.7	4.4	3.9
Puerto Rico (+4.9)	415 (65.2)	214 (33.6)	-43.9	11.2	13.3
	1898 (40.0)	1065 (22.4)	-43.9	5.6	5.4
Total	4003 (25.9)	3304 (21.3)	-17.5	5.2	4.5

Table C-2

REVISION OF TABLE 14 USING UNEDITED DATA ON MALE NONPRIOR SERVICE ENLISTMENTS
ARMY NATIONAL GUARD

State	Number of male NPS enlistments (and enlistment rate) Jan-June	July-Dec	% increase	Unemployment rate Jan-June	July-Dec
3x3 Group					
More than 10% understrength					
Connecticut (19.9)	147 (26.6)	189 (34.2)	28.6	5.8	5.3
Washington (19.1)	293 (50.9)	239 (41.5)	-18.4	8.2	6.9
Massachusetts (15.6)	227 (16.5)	485 (35.2)	113.7	7.2	6.4
Rhode Island (14.2)	37 (12.6)	84 (28.6)	127.0	6.3	6.0
Hawaii (13.1)	134 (40.2)	47 (14.1)	-64.9	5.6	5.6
Pennsylvania (12.1)	232 (13.9)	346 (20.8)	49.1	4.8	3.9
Wisconsin (12.0)	151 (16.4)	331 (35.9)	119.2	5.1	3.8
Texas (11.1)	372 (23.5)	487 (30.7)	30.9	3.2	2.9
Oregon (10.9)	319 (54.1)	234 (39.7)	-26.6	5.5	4.8
Ohio (10.2)	171 (12.1)	269 (19.1)	57.3	3.8	3.1
	2083 (22.4)	2711 (29.1)	30.1	4.9	4.2
Less than 10% understrength					
West Virginia (8.7)	99 (32.7)	62 (20.5)	-37.4	6.7	5.2
New Jersey (7.6)	281 (21.4)	760 (57.9)	170.5	7.3	6.3
Florida (5.1)	161 (21.1)	198 (26.0)	23.0	2.0	2.1
Mississippi (0.7)	330 (35.0)	237 (25.2)	-28.2	4.3	3.6
	871 (26.2)	1257 (37.9)	44.3	4.8	4.2
Overstrength					
Louisiana (+0.4)	490 (65.8)	748 (100.5)	52.7	6.4	5.3
New Mexico (+2.8)	188 (61.6)	139 (45.5)	-26.1	6.2	5.4
	678 (64.6)	887 (84.5)	30.8	6.4	5.3
Total	3632 (26.6)	4855 (35.5)	33.7	5.0	4.3
4x2 Group					
More than 10% understrength					
Dist. of Columbia (21.4)	55 (26.5)	48 (23.1)	-12.7	2.9	3.0
Nevada (15.4)	110 (86.2)	49 (38.4)	-55.5	6.3	5.3
Nebraska (14.7)	93 (22.9)	31 (7.6)	-66.7	3.6	2.7
California (13.3)	986 (48.2)	790 (38.6)	-19.9	5.7	4.6
Maryland (12.6)	388 (62.4)	437 (70.3)	12.6	4.4	3.7
Delaware (11.9)	91 (37.1)	56 (22.8)	-38.5	4.4	4.4
Kansas (11.4)	184 (26.7)	195 (28.2)	6.0	3.5	2.8
	1907 (43.9)	1606 (37.0)	-15.8	5.2	4.2
Less than 10% understrength					
South Carolina (9.2)	215 (23.2)	182 (19.7)	-15.3	3.8	3.5
North Dakota (7.5)	41 (18.1)	40 (17.7)	- 2.4	5.7	3.9
North Carolina (5.2)	319 (32.1)	408 (41.1)	27.9	2.8	2.2
Missouri (5.1)	124 (15.1)	131 (15.9)	5.6	4.5	3.6
Virginia (4.4)	42 (5.7)	163 (22.3)	288.1	2.7	2.4
Arizona (2.1)	136 (50.3)	75 (27.7)	-44.9	3.7	3.4
	877 (22.1)	999 (25.2)	13.9	3.4	2.9
Total	2784 (33.5)	2605 (31.3)	- 6.4	4.5	3.7

Appendix D

SOME RELATIONSHIPS BETWEEN INITIAL TOUR LENGTHS AND FORCE CHARACTERISTICS

This is a technical appendix to support the analysis reported in Section IV concerning the effects of shortening the initial term of enlistment upon average length of service, experience level, and personnel costs in the reserves.

Consider a force maintained by a k-year initial term of enlistment and having a "retention curve" $R(t)$, where $R(t)$ is the proportion of reservists who serve at least t years. If the maximum length of service in the force is M years and the major drop in retention occurs at the end of the k-year initial enlistment tour, then the graph of $R(t)$ might look something like Fig. D-1 below.

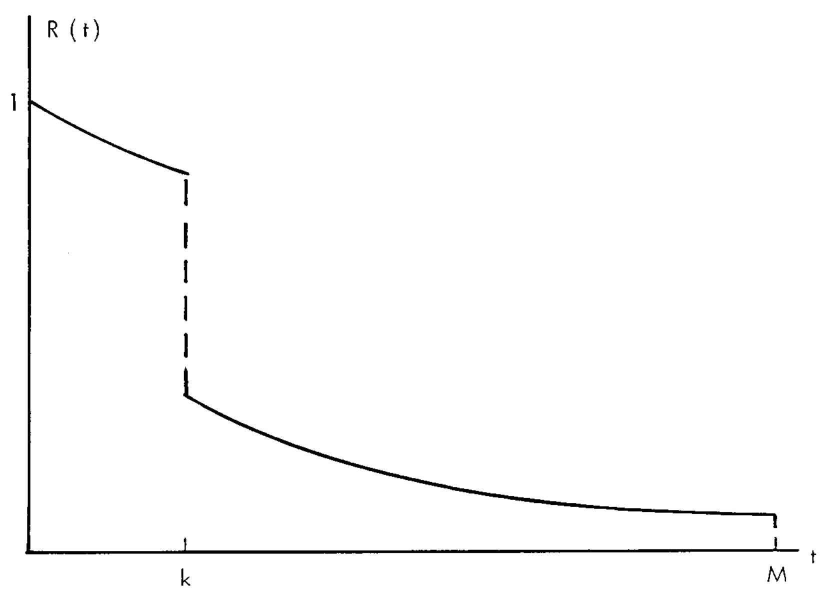

Fig. D-1 — Hypothetical retention curve

If enlistees enter the force at a uniform rate over time, then the force profile (plot of number of men versus years of service) has the same shape as the retention curve, so that in a "steady state" situation policy changes that affect the retention curve have an analogous effect on the force profile.

If we assume a constant annual attrition rate $1 - \gamma$ during the first k years and a possibly different annual attrition rate $1 - \delta$ thereafter up to M years, then the retention curve is

$$R(t) = \begin{cases} \gamma^t & \text{for } t < k \\ r\gamma^k\delta^{t-k} & \text{for } k \le t < M \\ 0 & \text{for } t \ge M \end{cases}$$

where r is the first term reenlistment rate. For purposes of illustration in Section IV, it was assumed that $\gamma = .95$, $\delta = .90$, $r = .25$, and $M = 25$. The values of R(t) for three-, four-, and six-year initial enlistment tours are given implicitly in Table D-1 where the values of R(t) are multiplied by 1000 to provide the expected number of enlistees remaining after each year of service under the three schemes, beginning with 1000 recruits initially.

Let T denote the length of service of a reservist chosen at random from new entrants into a force for which the retention curve is R(t). The average tour length of reservists in the force is the expected value of T, defined by $E(T) = \int t\, dF(t)$ where $F(t) = P(T \le t) = 1 - R(t)$. This expected value can be computed as the area under the retention function R(t)--i.e., $E(T) = \int_0^M R(t)\, dt$.[1]

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[1] C. R. Rao, Linear Statistical Inference and Its Applications, John Wiley, New York, 1965, p. 77. Manpower planners often approximate the expected value of T using the formula
$E(T) = \Sigma_{j=0}^{M} R(j) = \Sigma_{j=0}^{M} P(T > j)$. This approximation would be exact if there were no attrition except at the end of each year. As it is, the approximation tends to underestimate the true values. In this case, using the approximation amounts to summing the columns in Table D-1 and dividing by 1000. The results are 4.81, 5.55, and 6.92, as compared with the values 4.61, 5.34, and 6.67 obtained by using the exact formula. Note that the ratios of the expected values under the three tour lengths remain approximately the same under either method of calculation.

Table D-1

EXPECTED NUMBER OF ENLISTEES REMAINING AT THE END OF EACH YEAR OF SERVICE UNDER THREE-, FOUR-, AND SIX YEAR INITIAL ENLISTMENT TOURS WHEN $r=.25$, $\gamma=.95$, and $\delta=.95$

t	Number Remaining at the End of t Years if the Initial Tour Length is:		
	3 Years	4 Years	6 Years
0	1000	1000	1000
1	950	950	950
2	902	902	902
3	214	857	857
4	193	204	815
5	174	183	774
6	156	165	184
7	141	148	165
8	127	134	149
9	114	120	134
10	103	108	121
11	92	97	109
12	83	88	98
13	75	79	88
14	67	71	79
15	61	64	71
16	54	58	64
17	49	52	58
18	44	47	52
19	40	42	47
20	36	38	42
21	32	34	38
22	29	31	34
23	26	28	31
24	23	25	28
25	21	22	25

For the specification of the retention curve above, it follows that

$$E(T) = \int_0^M R(t)dt - \int_0^k \gamma^t dt + r\gamma^k \int_k^M \delta^{t-k} dt$$

$$= \frac{\gamma^k - 1}{\ln \gamma} + \frac{r\gamma^k(\delta^{M-k} - 1)}{\ln \delta}$$

Varying the parameters in this formula permits us to see how the average tour length for reservists is affected by the initial term of service, the reenlistment rate r, and the annual attrition rates. The expected tour lengths reported in Table 8 were for k = 3, 4, and 6 and for values of r ranging from 0.10 to 0.30. The attrition rates used were 5 percent for the first term and 10 percent thereafter--i.e., $\gamma = 0.95$ and $\delta = 0.90$. Since the retention curve does not specify further drops at later reenlistment points, the 10 percent drop in retention after the initial tour may underestimate the total actual attrition somewhat during the first 10-15 years of service, but this should not appreciably affect the comparisons of expected tour lengths that result from using Table 8.

Next consider how shortening the initial commitment affects the experience level of the force. One measure of the experience level is the proportion $q(j)$ of men who have less then j years of service. To compute this for a force having retention function $R(t)$, assume that new recruits enter the force at a uniform rate over time, so that the force profile has the same shape as the retention function. Then, since the proportion of men in the force having less than j years of service is the ratio of the area to the left of $t = j$ in the force profile to the total area of the force profile,[1]

$$q(j) = \int_0^j R(t)\, dt \Big/ \int_0^M R(t)\, dt = \int_0^j R(t)\, dt/E(T).$$

If $j < k$, the numerator of $q(j)$ is $\int_0^j \gamma^t dt = (\gamma^j - 1)/\ln \gamma$, which for $\gamma = 0.95$ has values 0.975, 1.901, and 2.781 for $j = 1, 2, 3$. The proportions $q(j)$ for $j = 1, 2$, and 3 are reported in Table D-2 for each of the initial tour lengths and various reenlistment rates. The same attrition rates are used as were used previously--namely, $\gamma = 0.95$ and $\delta = 0.90$. Note that recruits on active duty for training are counted as members of the force for the purpose of these calculations.

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[1]To make this argument more explicit, suppose that up to time $t = t_o$ there have been n recruits per year during the previous M years. If they enlisted at times $t_o - 1/n$, $t_o - 2/n$, ..., $t_o - nM/n$, then the number of recruits still in the force at time t_o is $\Sigma_{i=1}^{nM} I_i$, where I_i is 1 or 0 according as the recruit at time $t_o - i/n$ is still in the force or not. Since $P(I_i = 1) = R(i/n)$, the expected number in the force is $\Sigma_{i=1}^{nM} R(i/n) = n\, \Sigma_{i=1}^{nM} R(i/n)(1/n)$, and the latter summation is a Riemann sum that is approximately equal to $\int_0^M R(t)\, dt$ for large n. Similarly the number of recruits still in the force at time t_o who have less than j years of service is $\Sigma_{i=1}^{nj} I_i$, and the expected number is approximately $n \int_0^j R(t)\, dt$ for large n.

Table D-2

A COMPARISON OF EXPERIENCE LEVELS OF FORCES MAINTAINED
BY DIFFERENT INITIAL TOUR LENGTHS

First-term Reenlistment Rate	Experience Level j	Percentage of the Force Having Less than j Years of Service if Initial Tour Length Is		
		3 Years	4 Years	6 Years
0.10	1	28	23	17
0.15		25	21	16
0.20		23	20	15
0.25		21	18	15
0.30		20	17	14
0.10	2	54	44	33
0.15		49	41	31
0.20		45	38	30
0.25		41	36	28
0.30		38	33	27
0.10	3	79	65	48
0.15		72	60	46
0.20		65	56	44
0.25		60	52	42
0.30		56	49	40

In estimating the expected pay per reservist and per man-year as a function of initial tour length and the first-term reenlistment rate, we begin by estimating the amount of pay that a typical reservist receives during each year of service. The Army estimates that on average now recruits receive about $2700 in pay and allowances while on active duty for training. During the remainder of their first year in the reserves, they receive $12.11 per drill at the current rate of pay in grade E-2, which for 26 drills amounts to a total of $315. Thus, the average reservist who completes a full year of service receives approximately $3000. Thereafter, his pay goes up as he receives promotions and accumulates years of service. See Fig. 4. The numbers in the figure for years 2-6 are derived as indicated in Table D-3 assuming 63 drills per year (48 regular drills plus 15 days of summer camp):

Table D-3

PAY OF TYPICAL RESERVIST DURING FIRST SIX YEARS OF SERVICE

Years of Service	Pay Grade	Pay per Drill	Total Pay
2	E-3	$12.59	$793
3	E-4	13.82	871
4	E-5	15.53	978
5	E-5	16.21	1021
6	E-5	16.21	1021

After the sixth year the average pay for reservists goes up approximately linearly, reaching $1883 in the 25th year for an E-7, $2061 for an E-8, and $2338 for an E-9. Since few men reach grade E-9, the average pay of reservists in their 25th year was estimated to be $2000 per year under current pay rates, which for purposes of approximation can be regarded as the constant dollar equivalent of future pay rates. For the years between $t = 6$ and $t = 25$, it was assumed that the average reservist's pay increases linearly over time at a rate of $50 per year beginning at $1050 per year at $t = 6$.

Let $c(t)$ denote the pay curve depicted in Fig. 4. The average total pay for reservists having tour length T is the sum of the areas under the pay curve $c(t)$ up to time T. Taking into consideration the distribution of tour lengths as specified by the retention curve $R(t)$, the overall expected total pay $E(C)$ for new enlistees into the reserves can be obtained by multiplying each year's pay by the average value of $R(t)$ during the same year and summing over time. More formally,

$$E(C) = \int_0^M c(t)\ R(t)\ dt = \Sigma_{t=1}^{6}\ c(t)\ p(t) + \int_6^M c(t)\ R(t)\ dt,$$

where $p(t) = \int_{t-1}^{t} R(t)\ dt$, the average proportion of reservists who serve during the t^{th} year.[1]

The values of $E(C)$ for each of the three initial tour lengths and for various first-term reenlistment rates are given in Table 11.[2] The table also provides the expected amount of pay per man-year in the reserves. These are obtained by dividing the entries in the top half of the table by the expected tour lengths given in Table 8 of Section IV.

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[1] This calculation uses the fact that

$$\begin{aligned} E(C) &= E(E(C|T)) = \int_0^\infty E(C|t)dF(t) \\ &= \int_0^\infty \int_0^t c(t')\ dt'\ dF(t) = \int_0^\infty \int_{t'}^\infty dF(t)\ c(t')\ dt' \\ &= \int_0^\infty [1 - F(t')]\ c(t')\ dt' = \int_0^M c(t)\ R(t)\ dt. \end{aligned}$$

[2] The formulas for $p(t)$ and $\int_6^M c(t)\ R(t)\ dt$ for arbitrary values of γ, δ, r, and M are as follows:

$$\begin{aligned} p(t) &= (\gamma^t - \gamma^{t-1})/\ln \gamma \qquad &&\text{for } 1 \le t \le k \\ &= r\gamma^k(\delta^t - \delta^{t-1}/\delta^k \ln \delta \qquad &&\text{for } k < t \le 6, \end{aligned}$$

$$\int_6^M c(t)\ R(t)\ dt = \frac{r\gamma^k}{\delta^k \ln \delta} [750\ \delta^t + 50\ \delta^t\ (t - 1/\ln \delta)]\ \Big|_{t=6}^{t=M}\ .$$